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A revision of the African and Malagasy species of the genus *Leptomastix* (Hymenoptera, Encyrtidae), parasitoids of mealybugs (Homoptera: Pseudococcidae)

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CONTENTS

SYNOPSIS. The 11 species of *Leptomastix* known from Africa and Madagascar are revisedIllustrations117. Three are described as new (*herreni*, *africana*, *jonesi*), three synonymies are proposed (*lyciae* with *nigrocincta*, *phenacocci* with *nigrocoxalis*, *superba* with *dactylopii*), and a lectotype is designated for *algirica* Trjapitzin. A dichotomous key to all species is provided and each species is further characterised by a taxonomic diagnosis or description, and notes are provided on distribution, hosts and use in biocontrol.

INTRODUCTION

In recent years, increasing consideration has been given to alternative methods to the use of chemicals for pest control resulting from growing public concern about the effect of the indiscriminate use of pesticides on the environment. This is especially so in Africa where the continued use of pesticides may be unrealistic for reasons other than environmental risk alone, eg. poor financial resources or the remoteness of some of

the areas involved. In recent years, the use of natural enemies to control pests has proven to be a valuable alternative to pesticides. This form of control is relatively cheap, self sustaining and is not harmful to the environment. Furthermore, many biocontrol agents can disperse very rapidly over large areas thus greatly facilitating control in remote places. The recent spectacular successes of two encyrtid parasitoids introduced against two mealybug (Homoptera: Pseudococcidae) pests in Africa, *Phenacoccus manihoti* and *Rastrococcus invadens*, has done much to promote the use of biological control on the continent (see Neuenschwander, 1989, 1990; Herren & Neuenschwander, 1991; Agricola et al, 1989). However, these successes have also highlighted the need for reliable taxonomic work to facilitate the identification of pests and their parasitoids in order to provide early control. For instance, Rosen and DeBach (1979) pointed out that their taxonomic revision of *Aphytis* (Hymenoptera: Aphelinidae) resulted in some 35 new species being made available for biological control projects against armored scale pests (Homoptera: Diaspididae). On the other hand, misidentifications of pest or natural enemies can have potentially disastrous consequences. The control of *Phenacoccus manihoti* in Africa was delayed for several years because the pest mealybug was initially wrongly identified as having originated in Central America and northern South America whereas the species was actually of central South American origin (Herren & Neuenschwander, 1991; Noyes & Hayat, 1994).

Worldwide, several mealybug pests have been the subject of biocontrol projects utilising species of the encyrtid genus *Leptomastix*. This genus includes about 35 described species, all of which are almost certainly parasitoids of mealybugs and therefore have the potential to be used as biocontrol agents against these pests. To date, three species of *Leptomastix* have been associated with biocontrol projects (see below), especially in Africa and in greenhouses in Europe and North America. However, in Africa the species are poorly known, most being difficult to identify with any degree of certainty. The only available key to species is that of Compere (1938) which relies heavily on colour to discriminate between them. The present study is therefore an attempt to provide a reliable means of identifying the African species of *Leptomastix* by means of a dichotomous key to new and known species, together with diagnostic notes, illustrations and information on their distribution and hosts. The work is based on material collected from all over the African continent including north Africa and also Madagascar.

DEPOSITORIES

BMNH	The Natural History Museum, London, United Kingdom
IEEM	Instituto di Entomología Español, Madrid, Spain
IITA	International Institute of Tropical Agriculture, Cotonou, Benin
INMP	Università Degli Studi Di Napoli Federico II, Italy
MNHN	Muséum National d'Histoire Naturelle, Paris, France
NMP	Natural History Museum, Prague, Czech Republic
PPRI	Plant Protection Research Institute, Pretoria, South Africa
UCR	University of California, Riverside, California, USA
USNM	United States National Museum, Washington D.C., USA
ZAMU	Zoological Museum of the Aligarh Muslim University, India.

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TERMS AND MEASUREMENTS

Clava	Terminal segments of antenna, composed of one to three segments. Segments are separated by partial or complete sutures and are not as clearly separated as funicle segments.
EL	Maximum length of eye (see eye).
EW	Maximum width of eye (see eye).
Eye	The measurements of length (EL) and breadth (EW) are the maximum and minimum diameters respectively. The points from which the measurements are taken should be equidistant from the objective of the microscope (i.e. both in focus simultaneously). Occasionally, when stated, the length of an eye is measured in facial view from a slide mounted specimen.
F1, F2, etc.	First funicle segment, second funicle segment, etc.
Flagellum	All segments constituting the funicle and clava (sometimes termed flagellomeres).
Funicle	This is part of the antenna between the pedicel

and clava. There are no anelli present in *Leptomastix*.

FV Relative width of the frontovertex. The measurement is taken either in frontal view or from above and is the measurement across the narrowest part of the frontovertex which is normally near the anterior ocellus.

FWL Length of forewing excluding the marginal fringe and measured from the extreme base of the costal cell to the apex of the wing.

FWW Maximum width of the forewing excluding the marginal fringe and normally measured along an imaginary line at right angles to the anterior margin of the wing to the anal angle opposite.

GL Relative length of gonostylus.

Gonostylus Third valvula, or ovipositor sheath, as seen in slide-mounted material (Fig. 7).

HW Head width measured in facial view.

Hypopygium Apical, externally visible sternite of abdomen.

Linea calva An oblique hairless line extending from the stigmal vein to posterior margin of the forewing.

Marginal vein Measured from the distal margin of the subhyaline break at the apex of the submarginal vein to the distal margin of the stigmal vein where it joins the marginal and postmarginal veins. Occasionally the subhyaline break is obliterated but its position can be determined by the position of a single placoid sensillum on the dorsal surface of the submarginal vein a little before it joins the marginal vein. The position of the hyaline break is immediately distad of this sensillum.

MS Malar space or the minimum distance between eye and mouth margin. The measurement is taken as for the eye (above). Occasionally, when stated, the malar space is measured in facial view from a slide mounted specimen.

MT Length of middle tibia for comparison with length of the ovipositor or last tergite.

MV Relative length of marginal vein.

OCL The minimum distance between the posterior ocelli and occipital margin.

OL Relative length of ovipositor.

OOL Minimum distance between the eye margin and the nearest posterior ocellus.

Postmarginal vein Measured from the distal side of the stigmal vein where it joins the marginal vein to the apex of the postmarginal vein (Fig. 6). Its apex is occasionally indicated by a single erect seta, although in anagyrines this is frequently difficult to see or absent.

PMV Relative length of postmarginal vein.

POL Minimum distance between the posterior ocelli.

Scale-like structures Structures on apical segments of antennae of males which are usually scale-like in appearance (see Figs 60–68). These are almost certainly not sensilla but 'release and spread structures' associated with mating (see Isodoro *et al.*, 1996).

SL Relative length of the scape. This excludes the radicle and is most accurately measured along the internal surface of the scape.

Stigmal vein Measured from its proximal margin, where it joins the marginal vein, to its apex (Fig. 6).

SV Relative length of stigmal vein.

SW Maximum width of scape. This is best measured on a card-mounted specimen.

LEPTOMASTIX FÖRSTER

Leptomastix Förster, 1856: 34, 37. Type-species *Leptomastix histrio* Mayr by subsequent monotypy.

Sterrhocoma Förster, 1856: 33, 36. Type-species *Sterrhocoma histrio* Förster by monotypy. Synonymy with *Leptomastix* by Graham, 1969a: 216–217.

Stenoterys Thomson, 1876: 115, 128. Type-species *Stenoterys orbitalis* Thomson, by monotypy. Synonymy with *Leptomastix* by Mercet, 1921: 119.

Leptomastix belongs to the encyrtid subfamily Tetracneminae, tribe Anagyrini (see Noyes & Hayat, 1994 for diagnostic characters of these taxa) and can be separated from all other genera of Encyrtidae using the following combination of character states (characters separating *Leptomastix* from other anagyrine genera in italics).

DIAGNOSIS. Body moderately robust and stout, yellow, orange, dark brown or completely black; mandibles bidentate; maxillary palpi 4-segmented; labial palpi 3-segmented; *frontovertex between top of antennal scrobes and anterior ocellus with fairly regular, hexagonally reticulate sculpture of mesh size, about equal to that of an eye facet*; eyes not reaching occipital margin, normally separated by at least the diameter of an ocellus; eyes inconspicuously hairy, the hairs sparse and shorter than diameter of a facet; funicle 6-segmented; mesoscutum without notauli; sculpture on mesoscutum and scutellum finely reticulate but not hexagonally reticulate; *linea calva interrupted, but not closed*; filum spinosum absent; *forewing normally with postmarginal vein at least as long as stigmal, rarely shorter*; hindwings about 4–6× as long as broad; Female: scape subcylindrical, at least 4× as long as broad; all funicle segments clearly longer than broad, F6 shortest; clava 3-segmented; costal cell narrow with only a single complete line of setae ventrally; forewings varying, about 2.5–4× as long as broad; gaster with hypopygium reaching apex and paratergites present; ovipositor not longer than mid tibia and never exserted. Male: all funicle segments much longer than broad and clothed in long setae, normally at least about 3× as long as diameter of segments; *F6 without scale-like structures ventrally* (but see *digitariae*, Fig. 65);

clava solid and *with a line scale-like structures ventrally in basal half* (see Figs 61–68); forewings normally about 2.5–3× as long as broad; *phallobase with a pair of apical digiti, each with two or three hooks* (Figs 69, 70).

IDENTIFICATION OF SPECIES. Identification keys to species of *Leptomastix* include those of Compere, 1938 (Afrotropical); Trjapitzin, 1978 (western Palaearctic); Trjapitzin, 1989 (Palaearctic) and Noyes & Hayat, 1994 (Oriental).

DISTRIBUTION. *Leptomastix* includes about 35 described species and is almost exclusively Old World in distribution. The only possible exception is *Leptomastix dactylopii*, first described from Brazil and introduced throughout the New World and elsewhere. However it is very likely that this species is of Afrotropical origin (see Noyes & Hayat, 1994). The known species are fairly evenly distributed between the Palaearctic (12), Africa and Madagascar (11) and the Oriental region (16) with only three species known from Australia and New Zealand (one introduced), with some overlap between these regions.

BIOLOGY. Several workers have investigated the biology of *Leptomastix* species. Their records suggest that they are primary, solitary endoparasitoids of mealybugs (Moursi, 1948; Zinna, 1959). Bess (1939) and Lloyd (1958) recorded *Leptomastix dactylopii* ovipositing in several mealybug species while Bess (1939) and Su & Li (1993) found that, of the hosts tested, it would only develop successfully in *Planococcus citri*. However, numerous other mealybug species have been recorded as hosts of *dactylopii* (see Noyes & Hayat, 1994). Lloyd (1964) showed that host preference cannot be changed by rearing the parasitoid for several generations on an 'unnatural' host species. Van Baaren and Nenon (1994) reported some parameters relating to host discrimination and potential superparasitism in *Leptomastix* species, arguing that females can distinguish between unparasitised and parasitised hosts and generally avoid the latter more often, whatever the time elapsed since the first oviposition. Discrimination seems to be based on several markers which interact either simultaneously or successively. Kirkpatrick (1953) and Jong & Alphen (1989) reported that a female of *Leptomastix dactylopii* can lay up to ten eggs per day and that oviposition can take place into third instar or adult mealybugs. Fecundity is greatest at about 30°C (Tingle & Copland, 1989) and the egg is coated with minute spherulae which contain a protein which probably prevents encapsulation of the egg by the host (Barbier & Rambault, 1985; Barbier *et al.*, 1988). Zinna (1959) and Moursi (1948) respectively reported four larval instars for *Leptomastix dactylopii* and six for *nigrocoxalis* (=*phenacocci*). According to them, the number of segments varies from 11 to 13, the last four not clearly segmented in the earlier instars. Lloyd (in Zinna, 1959) reported that at 27°C, development in *Leptomastix dactylopii* is complete in a little over two weeks, development of the male generally being completed a day or two before the females. In *Leptomastix nigrocoxalis* (=*phenacocci*) the rate of development is linked to the age of the host into which oviposition has occurred. In 10-day-old hosts at 27°C, development takes 30 days, whilst in 20-day-old hosts, development is complete in 20 days (Moursi, 1948). Su & Li (1993) reported that the sex ratio of progeny of *Leptomastix dactylopii* was female biased, with males generally developing in smaller hosts. Adults of *Leptomastix nigrocoxalis* (=*phenacocci*) can live up to 70 to 80 days, females generally living longer than males (Moursi, 1948). In adults of *Leptomastix dactylopii*, longevity is slightly greater at 26°C. Battaglia and Tranfaglia (1994) reported that isolated adults of *Leptomastix dactylopii* lived longer than those in other conditions. Survival was strongly affected by diet; longevity without food was nearly three days while the highest values of longevity were recorded for adults fed with honey solution and pure honey.

USE IN BIOCONTROL. The use of the three species of *Leptomastix* which have been associated with biocontrol projects is summarised in Table 1.

Key to African species of *Leptomastix* (females and males)

1 Females: clava 3-segmented; flagellum with short appressed hairs 2

– Males: clava entire; flagellum with whorls of long setae, each longer than diameter of segments 12

FEMALES

2 Head completely yellow, without even dark areas on temples behind eyes; forewings at least about 3.5× as long as broad ..... *tsukumiensis* Tachikawa (p. 98)

– Head with at least temples behind eyes brown, sometimes completely blackish; forewings at most about 3× as long as broad 3

3 Forewing with postmarginal vein not more than one-third longer than stigmal vein (Figs 11, 18) 4

– Forewing with postmarginal vein at least about 1.5× as long as stigmal vein (Figs 25, 29, 35, 43, 53, 59) 6

4 Linea calva interrupted by at least 5 lines of setae (Fig. 10); tegulae with base white and apex brown .... *digitariae* Risbec (p. 100)

– Linea calva interrupted by at most 3 lines of setae (Fig. 17); tegulae with base orange and apex greyish brown or completely brown 5

Table 1. A summary of the worldwide use of *Leptomastix* species in biocontrol projects.

Parasitoid	Target pest	Country/Region	Year	Result	Reference
dactylopii	*Planococcus citri*	Australia (Qd)	1980	SCI	Smith *et al.* (1988)
		Belgium	1989	SCG	Ronse (1990)
		Bermuda	1952	NC	Cock (1985)
		USA (California)	1934	P	Compere (1939b), Bartlett (1978)
		Canada	1939–1945	SCG	Baird (1938,1939,1940a,1941, 1942,1943,1944,1946,1947), McLeod (1962), Turnbull & Chant (1961)
		Chile	1930–1958	SC	Duran (1944), Gonzalez & Rojas (1966), Graf Marin & Peña (1940)
		Costa Rica	1968	E	Molina (1977), Noyes & Hayat (1994)
		Cyprus	1966–1977	SC	Cock (1985), Greathead (1976), Krambias & Kotzionis (1980)
		UK	1982–1987	SCG	Copland (1983), Copland & Varley (1987), Tingle & Copland (1988a,b,1989)
		Georgia	1961	E	Kobakhidze (1965)
		Greece	?	P	Jourdheuil (1986)
		India	1983–1985	SC	Manjunath (1985b), Krishnamoorthy & Singh (1987), Ramesh (1987), Prakasan (1987)
		Israel	1984,1987	SCG	Argov & Rössler (1988), Rubin (1985)
		Israel	1941	NE	Rivnay (1960)
		Italy	1956–1980	SCI	Greathead (1976), Luppino (1979), Viggiani (1975a,c), Barbagallo et al. (1983), Longo & Benfatto (1982)
		Morocco	?	P	Jourdheuil (1986)
		Netherlands	1984	PG	Hennekam *et al.* (1987): Kole & Hennekam (1990)
		Pakistan	1985–1985	P	CIBC (1985,1986,1987)
		Portugal	?	P	Jourdheuil (1986)
		South Africa	1935	NR	Greathead (1971)
		Spain	1948,1977	NE	Carrero (1980a,b), Greathead (1976), Gomez Clemente (1951)
		Sweden	1989–1990	?	Noyes & Hayat (1994)
		Turkmenia	1968	SC	Niyazov (1969b)
		USA (California)	1934	P	Bartlett (1978)
		USA (Florida)	1934	SC	Watson & Thomson (1940a,b)
		USA (Texas)	1970–1983	SCG	Meyerdirk *et al.* (1978), Summy *et al.* (1986)
		Uzbekistan	1959–1960	E	Rozanova & Loseva (1963)
		Yugoslavia (former)	?	P	Jourdheuil (1986)
	Planococcoides njalensis	Ghana	1949–1955	NE	Greathead (1971)
	Planococcus kenyae	Kenya	1937,1938	NR	Greathead (1971)
	Pseudococcus comstocki	USA (California)	1973–1975	R	*Meyerdirk & Newell (1979)
	Pseudococcus calceolariae	Chile	1931	SC	Marco (1959), Rojas (1967)
abyssinica	*Planococcus citri*	USA (California)	1931	NR	Compere (1931)
nigrocoxalis	*Maconellicoccus hirsutus*	Egypt	1934	P	Kamal (1951)
	Nipaecoccus viridis	Jordan	1986	?	Meyerdirk *et al.* (1988)

* Parasitoid misidentified as *Leptomastix flava* (see below under *L. dactylopii*)

? – no subsequent information; E – established but no further information available; NC – established but no significant control achieved; NE – not established; NR – not released; P – partial control achieved; PG – partial control in greenhouses only; R – released but no further information available; SC – successful control achieved; SCG – successful control in greenhouses only; SCI – successful control by inundative releases only.

5 Scape less than 7× as long as broad (Fig. 15); mesoscutum clothed in fairly conspicuous translucent, silvery setae; forewing with marginal vein about as long as postmarginal (Fig. 18) ..... *herreni* Anga & Noyes **sp. n.** (p. 101)

– Scape at least 9× as long as broad; mesoscutum clothed in brown setae; forewing with marginal vein about 2× as long as postmarginal vein ... *algirica* Trjapitzin (p. 102)

6 Antenna with F1 at least 4× as long as pedicel (Fig. 22) ..... *africana* Anga & Noyes **sp. n.** (p. 103)

– Antenna with F1 not more than 3× as long as pedicel (Figs 26, 32, 33, 39, 49, 50, 56) 7

7 Bases of mandibles blackish, occasionally mouth margin also blackish; forewings completely hyaline, without any longitudinal fuscous streaks (Fig. 27, 34) 8

– Bases of mandibles yellow or orange, mouth margin never blackish; forewings frequently with two longitudinal fuscous streaks (Figs 41, 51) 9

8 Distance of posterior ocelli from eye margin (OOL) less than 1.4× distance from occipital margin (OCL); ocellar area of frontovertex orange, axillae orange ..... *nigocoxalis* Compere (p. 00)

– Distance of posterior ocelli from eye margin more than 1.4× distance from occipital margin; ocellar area of frontovertex and axillae dark brown ..... *nigra* Compere (p. 103)

9 Mid coxae completely yellow ..... *dactylopii* Howard (p.106)

Mid coxae at least partly brown 10

10 Linea calva interrupted by at least 4 lines of setae; mid coxae generally orange and only brown laterally ..... *jonesi* Noyes **sp. n.** (p. 108)

– Linea calva interrupted by not more than 4 lines of setae (Figs 52, 58); mid coxae completely brown or almost so 11

11 Hind and fore coxae concolorous, yellow ..... *nigrocincta* Risbec (p. 109)

– Hind coxae brown contrasting with yellow fore coxae ..... *abyssinica* Compere (p. 110)

MALES

12 Forewings with postmarginal vein not longer than stigmal vein; head mostly dark brown (Figs 14, 20, 21) 13

– Either forewings with postmarginal vein clearly longer than stigmal vein (Figs 31, 38, 46, 55, 60) or head orange without any brown areas 15

13 Tegulae white with brown apex; F6 with scale-like structures (Fig. 65) ..... *digitariae* (p.1 00)

– Tegulae with base orange or completely dark brown; only clava with scale-like structures (Figs 61, 62) (sometimes apparently absent) 14

14 Clava with 5–7 longish, slender, recurved scale-like structures (Fig. 61); head and thorax usually largely orange ..... *herreni* (p. 101)

– Clava with 5–7 short, straight, scale-like structures (Fig. 62); head and thorax dark brown ..... *algirica* (p. 102)

15 Hind coxae brown 16

– Hind coxae yellow 17

16 Fore coxae brown ..... *africana* (p. 103)

– Fore coxae yellow ..... *abyssinica* (p. 110)

17 Temples and occiput yellow ..... *tsukumiensis* (p. 98)

– Temples and occiput largely blackish 18

18 Scale-like structures arranged in line at base of clava very slender and elongate and difficult to distinguish from setae (Fig. 64) ..... *jonesi* (p. 108)

– Scale-like structures arranged in line at base of clava flattened and short and relatively easy to distinguish from setae (Figs 63, 66, 67) 19

19 Longest setae on F1 at least 4× as long as diameter of segment measured in middle (Fig. 63); mesosternum dark brown, almost black, mid coxae yellow; forewing with linea calva interrupted by not more than two setae (Fig. 45) ..... *dactylopii* (p. 106)

– Longest setae on F1 less than 4× as long as diameter of segments measured in middle (Figs 66, 67); mesosternum orange, or pale brown, mid coxae sometimes brown; forewing with linea calva normally interrupted by at least three setae, frequently by three or more lines of setae (Figs 31, 38, 55) 20

20 Forewing with linea calva interrupted by at most only three or four setae (Fig. 55); mandibles and mouth margin never darkened ..... *nigrocincta* (p. 109)

– Forewing with linea calva interrupted by at least five setae (Figs 31, 38); bases of mandibles and mouth margin sometimes blackish 21

21 Frontovertex and axillae almost completely orange ..... *nigrocoxalis* (p. 103)

– Frontovertex and axillae dark brown ..... *nigra* (p. 105)

REVISION OF SPECIES

Leptomastix tsukumiensis Tachikawa

(Figs 1–7, 68)

Leptomastix tsukumiensis Tachikawa, 1963a:66–68. Holotype, ♀ Japan, ELKU, not examined.

Leptomastix singularis Shafee, 1971:50–51. Holotype ♀, India, ZAMU, not examined). Synonymized with *tsukumiensis* by Noyes & Hayat (1994).

[*Leptomastix longipennis* Mercet; Otanes, 1935:503–504. Misidentification.]

DIAGNOSIS. Female (length 1.42–2.41): body

slender; including gaster generally dusky yellow to orange; head dusky yellow; mesopleuron orange, concolorous with mid coxa and mesosternum; forewing hyaline (Fig. 3) or with variable fuscous markings adjacent to anterior and posterior margins distad of venation (Figs 4, 5), sometimes also adjacent to linea calva (Fig. 5); posterior ocelli equidistant from eye and occipital margins or hardly closer to eyes; antenna (Figs 1, 2) with F1 generally at least about 2.5× as long as pedicel; forewing comparatively long and narrow, from slightly more than 3× as long as broad to about 4× (Figs 3–5); postmarginal vein varying from about as long as stigmal vein to about 1.3× as long and varying from slightly longer than marginal to a little shorter (Figs 6, 7); linea calva interrupted by 4 or 5 lines of setae (Figs 3–5); gaster as long as thorax. Male (length 0.90–1.80 mm): generally similar to female; funicular segments clothed in relatively short setae (Fig. 68), each generally not longer than twice as long as diameter of segments, although this can be variable (see below); a line of about 10 scale-like structures present on the basal half of clava; forewing completely hyaline, about 3.0× as long as broad; marginal vein slightly longer than postmarginal which is subequal to stigmal vein in length; aedeagus about one-third as long as midtibia; phallobase with elongate digiti, each with two elongate apical spines.

VARIATION. Slightly more extensive than in extralimital material (see Noyes & Hayat, 1994) in that in the female the forewing may vary from completely hyaline to almost uniformly dusky or with a distinct fuscous pattern (see Figs 3–5), the posterior ocelli may be conspicuously closer to the eye than occipital margin, the funicle segments vary from relatively slender (Fig. 1) to distinctly flattened (Fig. 2) with F1 varying from only 4× to nearly 7× as long as broad and the forewing may be only slightly more than 3× as long as broad. The males show some considerable variation in the density and length of setae on the funicle, some specimens having the setae relatively dense and short (about 2× as long as diameter of segments, see Fig. 68) whilst in others they may be relatively sparse and long (about 4× as long as diameter of segments, similar to Fig. 63).

HOSTS. *Leptomastix tsukumiensis* has been recorded from an unknown mealybug on *Citrus* sp. by Shafee (1971) and from *Ferrisia virgata* by Otanes (1935). This species is also recorded for the first time in Africa, from undetermined hosts.

DISTRIBUTION. Gambia, Ivory-Coast, Benin, Nigeria, Cameroon, Somalia, Kenya, Zambia, Zimbabwe, South Africa, Madagascar, India, Laos, Philippines, China and Japan.

MATERIAL EXAMINED.
Non-type material. **Gambia**, ♂2, Bakau, i.1978 (*Huggert*); 1♂, Fajara, i.1978 (*Huggert*); **Ivory Coast**, 1♂, Lamto, 6°13'N 5°02'W, 16.v.1985 (*Rasplus*); 8♀, 13♂, Lamto, 6°13'N 5°02'W, xi.1988 (*Noyes*); 1♀, Bouake, xi.1981 (*Cochereau*); **R.P. Benin**, 1♂, 25Km N Ohicon, 4.xii.1988 (*Noyes*); **Nigeria**, 11♀, 20♂, Kaduna St., 20 Km N Kaduna, 8.xi.1987 (*Noyes, Neuenschwander*); 1♂, 81Km NW Jos, 1.xi.1987 (*Neuenschwander*); 6♀, 6♂, Plateau St., 20 Km NW Jos, 12.xi.1987 (*Noyes, Neuenschwander*); 1♀, 6♂, Bauchi St., 74 Km W. Bauchi, 14.xi.1987 (*Noyes, Neuenschwander*); 1♀, Sokoto St., 54 Km E. Sokoto, 8.xi.1987 (*Noyes, Neuenschwander*); **Cameroon**, 1♀, Sanyere, 18.xii.81 (*Compton*); **Somalia**, 1♀, Lr. Shabelli Valley, Mogadiscio, v.1977 (*Bin*); **Uganda**, 1♂, Serere, 22.vii.1934, BM 1935–459 (*Ford*); **Kenya**, 1♀, Nairobi, Karen, vi.1982 (*Dewhurst*); **Zambia**, 1♀, 15Km E Lusaka, 11–19.ii.1980 (*Beaver*); **Zimbabwe**, 14♀, 2♂, Harare, Chishawasha, i.81–xii.84 (*Watsham*); **South Africa**, 3♀, Cape Province, Swellendam, 17.xii.31–18.i.32 (*Turner*), 16♀, 9♂, Cape Province, Ceres, various dates iii.1921–iv.1925 (*Turner*); 1♀, Cape Province, Matjesfontein, 7–13.xi.1928 (*Turner*); 1♀, Cape Province, summit of Du Toits Kloof, 4.v.1972 (*BMNH Southern African Expedition*); 1♀, Natal, Kloof, 1500ft (=572m), ix.1926 (*Turner*), 1♀, Natal, Cape Vidal, 28°10'S 32°32'E, 13.i.1981 (*Prinsloo*); 3♀, Tvl, D'Nyala Nat. Res. Ellisras District, 23°45'S 27°49'E, 23–26.ii. 1987 (*Prinsloo*); 1♀, Natal, Vernon Crookes Nat Res., Umzinto, 30°17'S 30°37'E, 443m, 25–26.iii.1985 (*Prinsloo*); 1♀, C.P., Andries Vosloo Kudu Res. nr. Grahamstown, 33°07'S 26°38'E, 30.xi.1983 (*Prinsloo, Grobbelaar*); 2♀, Tvl, Blyderivierspoortdaam Nat. Res., 24°32'S 30°47'E, 25–26.x.1984 (*Prinsloo*); 1♀, C.P., Grahamstown, 33°19'S 26°32'E, 13.i.1983 (*Prinsloo, Grobbelaar*); 1♀, Tvl, Hans Merensky nat. Res., 23°40'S 30°39'E, 27–30.i.1981 (*Prinsloo*); 1♀, Tvl, Mogol Nat. Res., Ellisras District, 23°58'S 27°45'E., 21.i.1983 (*Prinsloo*); 1♂, Tvl, Pretoria, T3754, iii.1971 (*Annecke*); 1♀, Tvl, Letsitele, xi.1978 (*Prinsloo*); also material from **India, Laos, China** and **Philippines** as detailed in Noyes & Hayat (1994). Material in BMNH, PPRI.

COMMENTS. In Africa, *Leptomastix tsukumiensis* can be recognized by its relatively narrow forewing which is usually infuscate along its anterior margin distad of the venation. It is most similar to *Leptomastix dactylopii* and can be separated on the coloration of the temple and mesosternum and relative lengths of the forewings. In *tsukumiensis* the temples and mesosternum are yellow and the forewings are 3.3–4.1× as long as broad whilst in *dactylopii* the temple and mesosternum are dark brown and the forewings are 2.6–3.0× as long as broad.

The considerable variation in both sexes as outlined above initally led us to believe that at least two species were present. After careful examination of all the material at hand we have been unable to recognise any discrete groups. Intermediate forms for all combinations of the variable character states are present in both African and Oriental material and therefore we are assigning all material listed above to *tsukumiensis*.

Leptomastix digitariae Risbec

(Figs 8–14, 65, 69)

Leptomastix digitariae Risbec, 1959:23–6. Lectotype ♀, designated by Noyes & Prinsloo (1998), Madagascar, examined, MNHN.

DIAGNOSIS. Female (length 1.70–1.85 mm): body, including gaster, dark-brown to black; head and dorsum of thorax clothed in white setae; tegulae yellow basally; legs brown, except mid tibia which is yellow; posterior ocelli closer to eye margin than occipital margin; antenna (Fig. 8) with F1 about 2× as long as pedicel, segments subequal in length; forewing (Fig. 9) hyaline and about 2.6× as long as broad; linea calva interrupted by five lines of setae; postmarginal vein slightly shorter than either marginal or stigmal veins (Fig. 11); gaster as long as thorax; ovipositor slightly exserted. Male (length 1.34–1.42 mm): generally similar to female but antenna (Fig. 65) with setae on funicle longer, up to 3.5× as long as diameter of F1; scale-like structures on F6 and clava.

FEMALE (PARALECTOTYPE). Body, including gaster, dark-brown to black; head and thoracic dorsum clothed in white setae; mandibles brown; antennae dark-brown; coxae dark brown; legs generally dark brown except for distal apex of mid femur and entire mid tibia which are yellow; mid tarsi testaceous; subalar sclerites pale-yellow; tegulae whitish basally, dark brown apically.

Head with inner eye margins diverging ventrad; frontovertex with regular, polygonally reticulate sculpture of fine mesh size which is on average a little smaller than an eye facet; piliferous punctures small, but distinct; posterior ocelli closer to eye margin than occipital margin; antennae (Fig. 8) as long as body; scape 5× as long as broad; pedicel 2× as long as broad; funicle segments subequal in length, at least 2× as long as broad; F1 1.6× as long as pedicel; clava 1.7× as long as F1 and twice as long as F6. Relative measurements: HW 85, HL 75, FV 35, POL 15.5, OCL 8, OOL 6, EL 52, EW 37, MS 23, SL 43, SW 12.

Thorax with mesoscutum regularly clothed in white setae; mesoscutum and scutellum with similar sculpture to frontovertex; wings hyaline; forewing (Fig. 9) about 2.6× as long as broad; linea calva interrupted by 5 lines of setae (Fig. 10); postmarginal vein (Fig. 11) about 0.75× as long as either marginal or stigmal veins; hindwing hyaline, 4.6× as long as broad.

Gaster as long as thorax, with ovipositor (Fig. 12) slightly exserted, the exserted part slightly shorter than the mid tibial spur.

MALE (PARALECTOTYPE). Similar to female, differing slightly as follows. Posterior ocelli equidistant from eye and occipital margins; linea calva interrupted by 3 lines of setae; antennae (Fig. 65) clothed with long setae, each about 4× as long as diameter of segments; F6 ventrally with 5 scale-like structures and clava with two. Aedeagus and phallobase as in Fig. 69.

VARIATION. Little in material available.

HOSTS. *Leptomastix digitariae* was reared originally from mealybugs on leaves of *Digitaria humberti*. (Poaceae) (Risbec, 1959).

DISTRIBUTION. Madagascar.

MATERIAL EXAMINED.

Type material. Lectotype ♀ originally mounted in slide labelled 'Leptomastix digitariae Risbec 1079' 'Leptomastix nigrocoxalis Compere 1079' '1079 1 ex, Leptomastix nigrocoxalis Compere 13 Leptomastix', remounted on card 21.vii.1988 by JSN and labelled 'LT ♀' on ventral side of card. Paralectotypes: 8♀, 6♂, same data as lectotype and remounted on cards. According to Risbec (1958:26) the type material was reared in Madagascar from mealybugs on the leaves of *Digitaria humberti* by Renaud Paulian. Lectotype and paralectotypes in MNHN, 1♀, 2♂ paralectotypes in BMNH.

Non type material. **Madagascar**, 1♀, Tananarive, Tsimbazaza Gdns, 27.v.1983 (*Noyes, Day*). Material in BMNH.

COMMENTS. *Leptomastix digitariae*, although superficially similar to several species of *Leptomastix* may be incorrectly placed in the genus and is retained in *Leptomastix* pending further work on the phylogenetic relationships of the taxa currently included in the tribe Anagyrini. A preliminary phylogenetic analysis of the taxa of this tribe undertaken by the first author was inconclusive with regards to the recognition of two separate lineages identified previously (see Noyes & Hayat, 1994). These lineages were defined on the sculpture of the frontovertex and the distribution of the scale-like structures on the antenna of the male. The lineage including *Leptomastix* includes species which have regular polygonal sculpture on the frontovertex and males with scale-like structures on the clava only. The second lineage, which includes *Anagyrus*, is defined by irregular, fine sculpture on the frontovertex and presence of scale-like structures on F6 of the male antenna. In *L. digitariae* the sculpture is somewhat intermediate, and scale-like structures are present on F6.

Leptomastix digitariae is superficially similar to *Leptomastix herreni*, both sharing the same general

coloration of the body (dark-brown to black), white setae on the head and relatively short postmarginal vein of the forewing. Apart from the sculpture of frontovertex and distribution of scale-like structures on the antenna of the male as stated above, they can be separated by the relative position of the posterior ocelli, the colour of the tegulae and in the females by the number of lines of setae interrupting the linea calva. In *digitariae* the posterior ocelli are closer to the eye than the occipital margin and the tegulae are basally yellow and the linea calva of the female is interrupted by five lines of setae (Fig. 10) whilst in *herreni* the posterior ocelli are closer to the occipital margin than the eye, the tegulae are completely brown and the linea calva of the female is interrupted by only three lines of setae (Fig. 17). There is also some similarity between *digitariae* and *algirica* (see comments under *algirica*).

Leptomastix herreni Anga & Noyes **sp. n.**

(Figs 15–20, 61)

DIAGNOSIS. Female (length 0.50–1.70 mm): colour varying from almost completely orange to almost completely dark brown (see below); at least mid and hind coxae orange-brown to dark brown; wings hyaline; inner eye margin diverging ventrad; minimum width of frontovertex 0.8–1.2× eye length; posterior ocelli closer to occipital margin than eye margin; F1 about as long as pedicel to twice as long; forewing about 2.5× as long as broad (Fig. 16); postmarginal vein only about as long as either marginal or stigmal or even slightly shorter (Fig. 18); linea calva interrupted by 2 or 3 lines of setae (Fig. 17); gaster as long as thorax. Male (length 0.50–1.35 mm): generally similar to female in coloration, but each torulus always connected to mouth margin by a yellowish streak even in the darkest specimens; antennae (Fig. 61) clothed with long setae, the longest about 3× as long as diameter of F1, F1 twice as long as pedicel, basal half of clava with about 8–10 very fine, recurved scale-like structures ventrally; forewings about 2.3× as long as broad; postmarginal vein very nearly as long as stigmal (Fig. 21).

FEMALE (HOLOTYPE). Length 1.48 mm. Head dark-brown, with inner eye margins yellow; temples dark-brown, occiput dark orange-brown, dark brown adjacent to temples; clypeal area pale orange, with white setae; mandibles dark-brown; radicle dark-brown; scape brown dorsally and dusky-orange ventrally; flagellum unicolorous brown; dorsum of thorax dusky-orange, dark brown on dorsal part of pronotum, anterior margin of mesoscutum, axillae, anterior median part of scutellum and metanotum; mesopleuron orange; prosternum anteriorly and mesosternum brown; mid coxa orange-brown; fore coxa brown anteriorly; subalar sclerites below base of forewing dusky-yellow; propodeum dark brown with spiracular area orange; gaster dark-brown.

Head with inner eye margin diverging ventrad; width of frontovertex 0.85× eye length; posterior ocelli closer to occipital margin than eye margin; antennae (Fig. 15) 0.9× as long as body; scape 5× as long as broad; F1 about as 1.5× as long as pedicel; clava 1.5× as long as F1 and 2.1× as long as F6; pedicel 1.9× as long as broad. Relative measurements (holotype): HW 101, HH 92, FV 50, POL 19.5, OCL 5, OOL 11, EL 58, EW 37, MS 28, SL 52, SW 10.

Thorax and gaster: mesoscutum and scutellum with finely reticulate sculpture; wings hyaline; forewing (Fig. 16) about 2.6× as long as broad; linea calva interrupted by two or three lines of setae (Fig. 17); postmarginal vein about 0.7× as long as either marginal or stigmal veins (Fig. 18); hindwing 4.2× as long as broad; gaster as long as thorax, with ovipositor hidden. Relative measurements: FWL 230, FWW 90; HWL 153, HWW 36.

Gaster as long as thorax, with ovipositor (Fig. 19) hidden. Relative measurements (paratype): OL 35, MT 51.

MALE. See diagnosis. Relative measurements: HW 45, FV 27, POL 10, OOL 7, OCL 2.5, EL 23, EW 16, MS 14, SL 20, SW 5; FWL 103, FWW, 45.

VARIATION. The most noticeable variation is that of colour, in both sexes from almost completely orange with only the mandibles, interantennal prominence, occiput, pronotum, tegulae and gaster brown to completely brown, including all coxae and femora, but not the tibiae and tarsi which are always more or less orange. Morphological variation is mostly related to size. The smallest females have a slightly wider frontovertex, antennae about as long as the body, and the postmarginal vein slightly longer than either the marginal or stigmal veins. Some larger females may have the scape only about 4× as long as broad and F1 about 2× as long as the pedicel. Smaller males tend to have relatively shorter setae on the funicle and fewer scale-like structures on the clava.

HOSTS. *Leptomastix herreni* recorded below from *Octococcus* sp. on Compositae and 'mesem', from *Octococcus pentziae* on *Pentzia globosa*, *Octococcus* sp. nr *pentziae* on *Athenasia trifurcata*, *Octococcus* sp. on *Oedera imbricata*, and unidentified mealybugs on *Rehlania ericoides*, *Chrysocoma* ?*coma-aurea*, and ?*Athenasia* sp.

DISTRIBUTION. South Africa.

MATERIAL EXAMINED.

Type-material: Holotype ♀, **South Africa**, C.P., Klipheuwel, ex *Octococcus* sp. on Compositae, T2783, x.1968 (*Insley*). Paratypes: **South Africa**, 9 ♀, 5 ♂,

C.P., x.1968, ex mealybug on *Rehlania ericoides*, T2779, x. 1968 (*Insley*); 2♀, 2♂, C.P., Klipheuwel, ex *Octococcus* sp. on Compositae, T2783, x.1968 (*Insley*) 3♀, 2♂, same data as holotype; 3♀, 2♂, C.P., Tulbagh district, ex mealybug on *Rehlania ericoides*, T2833, x.1968 (*Gilliomee*); 6♀, 5♂, C.P., Caledon, x.1969, ex *Octococcus* sp.n. on *Oedera imbricata*, T3219, x.1969 (*Insley*); 3♀, 1♂, C.P., Villiersdorp District, ex mealybug on *Chrysocoma ?coma-aurea*, T3217, x.1969 (*Insley*);1♀, 1♂, C.P., Paarl, x.1971, H.P.Insley, ex mealybug on Cape Macchia, T3971, x.1971 (*Insley*); 1♀, 4♂, C.P., Worcester, ix.1972, ex mealybug on unknown plant, T4525, ix.1972 (*Neser*); 3♀, C.P., Windmeul nr Paarl, ex *Octococcus* sp. nr. *pentziae* on *Athenasia trifurcata*, T4922, 3.x.1974 (*Prinsloo*) 2♀, 1♂, C.P., Ceres, 9.x.1974, on *Rehlania genistaefolia*, T4927, 9.x.1974 (*Prinsloo*); 9♀, 6♂, C.P., Tulbagh, ex *?Octococcus* sp. on *?Athenasia* sp., T5469, vi, 1978 (*Neser*); 5♀, 9♂, OFS, Edenville, OFS, ex *Octococcus pentziae* on *Pentzia globosa*, T3503, i.1970 (*Insley*); 2♀, 3♂, C.P., Oudtshoorn, ex *Octococcus* sp. on 'Mesem', T6915, iii.1979 (*Laubscher*). Holotype in PPRI, paratypes in PPRI and BMNH.

COMMENTS. *Leptomastix herreni* is most similar to *nigra*, both species having the same variable colour from largely orange to more or less completely dark brown or blackish and the ocelli closer to the occipital margin than to the eyes. They differ in the number of lines of setae interrupting the linea calva and the relative length of the postmarginal vein of the forewing. In *herreni* there are at most three lines of setae interrupting the linea calva (Fig. 17) and the postmarginal vein is about as long as the stigmal (Fig. 18) whereas in *nigra* there are generally at least four lines of setae interrupting the linea calva (Fig. 34) and the postmarginal vein is at least about 1.5× as long as the stigmal (Fig. 35). The males can be separated as in the females by the relative length of the postmarginal vein (compare Figs 20, 38) and number of lines of setae interrupting the linea calva and also by the number and structure of the scale-like structures on the clava. In *herreni* there are about 8–10 very fine, almost seta-like, recurved structures (Fig. 61) whilst in *nigra* there are only about 6 relatively broad, distinctly flattened structures (Figs 66, 67). The species is also very similar to *Leptomastix nigrocoxalis* and *Leptomastix digitariae* (see under *nigrocoxalis* and *digitariae* for comments). Paler forms of *herreni* might be mistaken for *flava* but the females differ in having the forewings completely hyaline, the mandibular bases almost black, and only two or three lines of setae interrupting the linea calva whereas in *flava* the forewings are frequently distinctly infuscate, the mandibles are orange and there are four or five lines of setae interrupting the linea calva. The males on the other hand can be separated by the elongate, recurved scale-like structures on the clava whilst those in *flava* are very short and broad.

The species is named in honour of Dr Hans Herren for his contribution to biological control in Africa.

Leptomastix algirica Trjapitzin

(Fig. 21, 62)

Leptomastix algirica Trjapitzin 1989:126. LECTOTYPE ♂ (here designated), Algeria, NMP, examined.

DIAGNOSIS. Female (length 1.40–1.50 mm): body moderately robust; generally dark brown, including coxae, femora and gaster; mouth margin yellowish; tibiae and tarsi pale orange; wings hyaline; F1 about 2× as long as pedicel; posterior ocelli slightly closer to occipital margin than eyes; forewing 2.5× as long as broad; postmarginal vein variable, from slightly shorter than stigmal to about one-third longer; stigmal vein about as long as marginal vein; linea calva interrupted by 2 to 4 lines of setae; gaster as long as thorax. Male (length 0.90 mm): similar to female; antennae clothed with long setae, longest about 3.3× as long as diameter of F1; base of clava with 5 or so scale-like structures ventrally; forewing venation as in Fig. 21.

VARIATION. Little in material examined, but see comments.

HOSTS. Unknown, but see comments.

DISTRIBUTION. Greece, Cyprus, Algeria

MATERIAL EXAMINED.

Type material. LECTOTYPE ♀, here designated: **Algeria**, 1♀, Aures: Ain Zaatout, 1.–4.vi.1971 (*Hoffer, Horak* [Expedition 'SCARABAEUS']) 'Holotypus *Leptomastix algirica* Hoffer ♀'. Paralectotypes: **Algeria**, 1♀, Biskra, 7.–8.vi.1971 (*Hoffer, Horak* [Expedition 'SCARABAEUS']); 1♂, Auresi, Ainzaatout, 1.–4.vi.1971 (*Hoffer, Horak* [Expedition 'SCARABAEUS']. Lectotype in NMP, paralectotypes in BMNH.

Non-type material. **Greece**, 1♀, Kos, 4Km W Kos Town, 20.viii.1994 (*Noyes*); **Cyprus**, 1♀, 13Km SW Kyrenia, Karaman, 22–23.viii.1993 (*Noyes*). Material in BMNH, both specimens part of longer series of probably the same species.

COMMENTS. The name *algirica* was made available in a review of the Palaearctic Encyrtidae by Trjapitzin (1989) and accredited to Hoffer. However, in that publication there is no indication that Hoffer was responsible for meeting the criteria for making the name available and therefore in compliance with Article 50 of the International Code of Zoological Nomenclature (1985) the name is here attributed to

Trjapitzin. No reference was made to the primary type by Trjapitzin and therefore a lectotype is selected above.

We are of the opinion that *algirica* may be a dark form of *epona* Walker since we are unable to find any consistent morphological characters to separate the two. We have examined a long series (BMNH) of specimens reared in Israel from *Pseudococcus cryptus* which have been identified as *algirica*. Females of this series vary from entirely dark brown as in the type material of *algirica* to the scutellum being almost entirely orange. The males are inseparable from darker forms of *epona* from western Europe. For the present we are not including this material in the present study because this 'Israeli' form is currently the subject of experimental studies to ascertain its status.

Leptomastix africana Anga & Noyes **sp. n.**

(Figs 22–25)

DIAGNOSIS. Female (length 1.30–1.60 mm): body including gaster dark-brown to black; all coxae dark brown; F1 nearly 4× as long as pedicel (Fig. 22); posterior ocelli closer to occipital margin than eye margin; wings hyaline; forewing (Fig. 23) about 2.7× as long as broad; postmarginal vein about twice as long as stigmal vein which is subequal to marginal (Fig. 25); linea calva interrupted by two lines of setae (Fig. 24); gaster as long as thorax. Male (1.10–1.40 mm): generally similar to female but antennae clothed with long setae, the longest about 5× as long as diameter of F1; basal half of clava with 9 or so scale-like structures ventrally.

FEMALE (HOLOTYPE). Length 1.48 mm. Body including gaster dark-brown to black; lower face with conspicuous silvery setae; antennae dark-brown; mesoscutum with constrasting silvery setae; scutellum similar to mesoscutum but setae not as conspicuous; wings hyaline; all coxae brown; femora brown but for apex of mid femora which is yellow; fore and hind tibiae and tarsi brown; mid tibia and tarsi pale orange; propodeum laterally with silvery setae.

Head with inner eye margins diverging ventrad; minimum frontovertex width slightly less than eye length; posterior ocelli closer to occipital margin than eye; antennae (Fig. 22) 1.3× as long as body, scape 5× as long as broad, pedicel 1.25× as long as broad, F1 nearly 4× as long as pedicel, clava 1.2× as long as F1 and 2× as long as F6. Relative measurements (holotype): HW 43, HH 40, FV 22, POL 15, OCL 5, OOL 8, EL 22, EW 7, MS 12, SL 25, SW 5.

Thorax with finely reticulate sculpture on mesoscutum and scutellum; forewing (Fig. 23) about 2.7× as long as broad, with postmarginal vein twice as long as either marginal or stigmal veins (Fig. 25); linea calva interrupted by two lines of setae (Fig. 24); hindwing hyaline, about 4.4× as long as broad.

Gaster as long as broad, with ovipositor hidden. Relative lengths (paratype): OL 29, MT 65.

MALE. Generally similar to female but inner eye margin subparallel, minimum frontovertex width about equal to eye length, forewing about 2.6× as long as broad, linea calva interrupted by a single line of setae, antennae clothed with long setae, the longest about 5× as long as diameter of F1; basal half of clava with 9 or so scale-like structures ventrally.

VARIATION. Very little except in body colour and size: smaller specimens tend to be brownish and larger ones dark-brown to black.

HOSTS. *Leptomastix africana* has been reared from a mealybug, probably *Octococcus* sp., on *Elytropappus rhinocerotis* (see below).

DISTRIBUTION. South Africa.

MATERIAL EXAMINED.
Type material. Holotype ♀: **South Africa**, C.P., Stellenbosch, Idas Valley, ex ?*Octococcus* sp. on *Elytropappus rhinocerotis*, T5976, ii.1979 (*Neser*). Paratypes: **South Africa**, 3♀, 1♂, same data as holotype; 2♂, C.P., Paarl, ex ?*Octococcus* on *Elytropappus rhinocerotis*, T2737, ex 14.x.1968 (*Insley*); 7♀, 3♂, Cape Province, Ceres, iii.1925 (*Turner*). Holotype in PPRI, paratypes in PPRI, BMNH and IITA.

COMMENTS. *Leptomastix africana* is most similar to *abyssinica* and *nigrocincta* (see comments under those species).

Leptomastix nigrocoxalis Compere

(Figs 26–31)

Leptomastix nigrocoxalis Compere, 1928:219–220. Holotype ♀, South Africa, USNM, not examined.

Leptomastix phenacocci Compere, 1938:325. Holotype ♀, Egypt (ex. Java), BMNH, examined. **syn. n.**

[*Leptomastix flavus* Mercet; Risbec 1951:103. Misidentification (part).]

Leptomastix brevis Hayat, Alam & Agarwal, 1975:14–16. Holotype ♀, India, BMNH, examined. Synonymized with *Leptomastix nigrocoxalis* by Noyes & Hayat (1994).

Leptomastix aligarhensis Khan & Shafee, 1975:194. Holotype ♀, India, ZAMU, not examined. Synonymized with *Leptomastix nigrocoxalis* by Noyes & Hayat (1994).

Leptomastix longiscapus Khan & Agarwal, 1976:378–380. Lectotype ♀ (designated Noyes & Hayat, 1994), India, ZAMU. Synonymized with *Leptomastix nigrocoxalis* by Noyes & Hayat (1994)).

DIAGNOSIS. Female (length 0.90–2.10 mm): body

including gaster orange to dusky orange; head with a dark brown area adjacent to each eye which extends across occiput towards foramen; mandibles always with bases dark brown, almost black; mesoscutum completely orange or with a brown wedge-shaped mark medially; mesosternum always brown and mid coxa always dark-brown; wings hyaline; position of ocelli relative to eye and occipital margin variable, generally about equidisant from eye and occipital margin, but sometimes clearly a little closer to occipital margin; antenna (Fig. 26) with F1 about 1.3–2.0× length of pedicel; forewing (Fig. 27) about 2.7× as long as broad; postmarginal vein about 1.5× as long as stigmal or slightly longer (Fig. 29); linea calva interrupted by 4 or 5 lines of setae (Fig. 28); gaster as long as thorax. Male (length 1.06–1.50 mm): generally similar to female, but head and thorax predominantly yellow; head with a dark-brown area on occiput adjacent to each eye, extending towards foramen; mandibles varying from orange to dark brown; dorsum of thorax orange or with anterior part of mesoscutum marked with dark brown; metanotum and sides of propodeum yellow; side and sternum of thorax mostly dusky-yellow; mid coxae occasionally hardly darkened; legs pale orange except mid and hind tibia which is brown dorsally; tarsi of fore and hind legs brownish, those of midlegs dusky-yellow except towards apex; funicle clothed in setae about 3× as long as diameter of segments; antenna with 5 or 6 scale-like structures on base of clava; forewing about 2.5–2.8× as long as broad; linea calva interrupted by about four lines of setae; aedeagus a little more than one-third as long as mid tibia, each digitus with a pair of moderate apical teeth.

VARIATION. The colour of the dorsum of the thorax of both sexes varies as outlined above. In general the frontovertex is not more than half head width with posterior ocelli about equidistant from eye and occipital margin, OOL:OCL never greater than 1.4.

HOSTS. *Leptomastix nigrocoxalis* has been recorded as a parasitoid of *Nipaecoccus graminis* on *Hyparrhenia hirta* (Prinsloo, 1981); *?Nipaecoccus graminis* on wild grass (Compere, 1928); *Pseudococcus* sp. on *Melia azedarach*, 'coccid' on hibiscus (Risbec, 1959); *Planococcus citri* on *Citrus medica* (Agarwal, 1965) and on coffee (Prakasan and Kumar, 1985); and *Rastrococcus cappariae* (Avasthi and Shafee, 1983); *Maconellicoccus* (=*Phenacoccus*) *hirsutus* (Compere, 1939c) and *Nipaecoccus viridis* (Moursi, 1948; as *Pseudococcus filamentosus* Cockerell, misidentification). It has also been recorded by Hayat *et al.* (1975) from *Coccidohystrix* (=*Centrococcus*) sp. on *Achyranthes aspera* and *Pupalia lappacea; Coccidohystrix* (=*Centrococcus*) *insolita* on *Achyranthes aspera* and *Wittania somnifera; Nipaecoccus* sp. on citrus, *Acacia, Peritropha bicalyculata* and *Morus alba*; *Nipaecoccus viridis* on *Ziziphus, Acacia* and *Tephrosia purpurea*, a 'coccid' on *Tamarindus indica, Leucas cephalotus, Hemigraphes* and *Acacia*, and from the margarodid *Icerya aegyptica*. Additionally recorded from *Rastrococcus iceryoides* on *Ziziphus* and from *Pseudococcus* sp. on tamarind (Noyes & Hayat, 1994). The record of this species as a parasitoid of *Nimboa basipunctata* (Neuroptera, Coniopterygidae) by Sharma *et al.* (1985) is unlikely and requires confirmation as does the record from *Saissetia nigra* (CIBC, 1970).

DISTRIBUTION. Egypt, Sudan, Zimbabwe, Namibia, South Africa, India and Indonesia.

MATERIAL EXAMINED.

Type material. Holotype ♀ of *Leptomastix phenacocci*: 'Egypt sent by Priesner' 'ex *Pseudococcus hirsutus*'; according to Priesner in Compere (1939c) this was from material originally obtained in **Indonesia** (Java) (BMNH); paratypes of *Leptomastix phenacocci*: 6♀, 5♂, same data as holotype (BMNH, UCR). Holotype ♀ of *Leptomastix brevis*, **India**, Kerala, Kalamasseri, ex *Icerya aegyptica* (Douglas), 12.iii.1967 (*Hayat*) (BMNH). Lectotype ♀ of *Leptomastix longiscapus*: **India**, Uttar Pradesh, Garhwal, ex coccid on citrus, 5.ix.1975 (*Khan*) (ZAMU); Paralectotypes of *Leptomastix longiscapus*: **India**, 9♀, 4♂, same data as holotype (ZAMU).

Non-type material. **Sudan**, 1♀, Wad Medani, from mealybugs on *Tamarindus indica*, 17.v.1939 (*Cowland*); 1♀, Wad Medani, ex mealybug on *Citrus medica*, ii.1938 (*Ruttledge*); **Egypt**, 5♀ Giza, 7.ix.1929, ? hibiscus mealybug breeding room, (*Kamal*); **Senegal**, 12♀, 6♂, Louga, ex cochenille sur *Euphorbia*, 1945 (*Risbec*) (misidentified as *Leptomastix flava* by Risbec); 1♀, Bambey, sur Sourour (misidentified as *Leptomastix flava* by Risbec); **South Africa**, 3♀, 5♂, Tvl, Dendron, ex, mealybug on grass, T6067, i.1980 (*Prinsloo*); 1♀, Tvl, Soutpan, Pretoria Dist., 25°24'S 28°06'E, 11–12.i.1984 (*Grobbelaar*); 11♀, 1♂, Tvl, Levubu Tvl, ex mealybug on grass, T6924, i.1987 (*Prinsloo*); 1♀, Tvl, Entabeni For. Res., 33°00'S 30°16'E, 7–1.i.1987 (*Prinsloo*); 1♀, Tvl, Weltevreden Farm nr Karino, ii.1990 (*Prinsloo*); **India**, material as listed in Noyes & Hayat (1994). Material in BMNH, PPRI.

COMMENTS. Although there are slight differences in the coloration of the head and mesoscutum of type and other material identified as *phenacocci* and *nigrocoxalis* (see Noyes & Hayat, 1994) we are unable to find any significant morphological characters by which to separate the two and therefore we treating the two names as synonyomous.

Leptomastix nigrocoxalis is very close to *nigra*, the species possibly being synonymous (see comments

under *nigra*). It is also very similar to *nigrocincta* (see comments under *nigrocincta*). At a glance, females of *nigrocoxalis* may be mistaken for those of *herreni* but can be separated readily on the relative length of the postmarginal vein. In *nigrocoxalis* the postmarginal vein is at least nearly twice as long as the stigmal (Fig. 29) whereas in *herreni* it is only about as long as the stigmal vein (Fig. 18). *Leptomastix nigrocoxalis* might be confused with *epona* and *histrio*, both of which are Palaearctic species and yet to be recorded in Africa. Females of *nigrocoxalis* can be distinguished from both of these species by the blackish mandibular bases, postmarginal vein at least about twice as long as the stigmal, brown mid coxae and hyaline forewings. In both *epona* and *histrio* the mandibular bases are always orange or orange-brown, the postmarginal vein is at most only about 1.5x as long as the stigmal, the mid coxae are orange, except in uniformly dark brown specimens, and the forewings almost always have two faint longitudinal fuscous streaks (similar to *dactylopii*). The males are very similar to those of *dactylopii*, *nigrocincta*, and *nigra*, but can be can be separated with difficulty using the characters given in the key. It is possible that these characters are unreliable.

Leptomastix nigra Compere

(Figs 32–38, 66–67)

Leptomastix nigrum Compere 1938:324–5. Holotype ♀, South Africa, examined, BMNH.

DIAGNOSIS. Female (length 0.50–2.10 mm): head and thorax varying from orange with frontovertex and axillae dark brown, to almost completely dark brown, blackish; paler specimens always with a dark-brown area adjacent to each eye, extending across occiput, towards foramen, mandibles always with bases dark brown, almost black; mesosternum always brown and mid coxa always dark-brown; wings hyaline; gaster mostly dark brown, occasionally mixed with orange basally; posterior ocelli clearly closer to occipital margin than to eye; antenna (Figs 32, 33) with F1 about as long as pedicel to about twice as long; forewing (Fig. 34) about 2.7× as long as broad; postmarginal vein about 1.5x as long as stigmal or slightly longer (Fig. 35); linea calva interrupted by about 4 or 5 lines of setae, 3 lines in the smallest specimens; gaster as long as thorax; ovipositor as in Fig. 36. Male (length 0.50–1.50 mm): generally similar to female, but head and thorax always largely yellow; head with a dark-brown area on occiput adjacent to each eye which extends towards the foramen; median area of frontovertex brown; mandibles varying from orange to dark brown; mesoscutum orange laterally and brown to dark-brown medially; axillae dark-brown; scutellum orange to dark brown; metanotum and sides of propodeum yellow; side and sternum of thorax mostly dusky-yellow; mid coxae occasionally hardly darkened; legs pale orange except mid and hind tibia which are brown dorsally; tarsi of fore and hind legs brownish, those of midlegs dusky-yellow except towards apex; funicle (Fig. 66, 67) clothed in setae about 3× as long as diameter of segments; five or six scale-like structures on base of clava; forewing (Fig. 37) about 2.5–2.8× as long as broad; linea calva interrupted by about four lines of setae (Fig. 38); aedeagus a little more than one-third as long as mid tibia, each digitus with a pair of moderate apical teeth.

VARIATION. As mentioned in the diagnosis for the females there is a notable amount of variation in the colaration of the body, some specimens being largely yellow or pale orange, but almost without exception with the axillae dark brown whilst in others the head and thorax is more or less completely dark brown. We have also noted variation in the relative lengths of the antennal segments with the smallest specimens having F1 only about as long as the pedicel (Fig. 33) whilst in larger specimens it may be about twice as long (Fig. 32). On the other hand, apart from a slight variation in the relative lengths of the funicle segments (Figs 66, 67), males appear to vary little. Some males have the brown areas of the dorsum of the thorax more extensive than others with sometimes the whole of the scutellum almost completely dark brown.

HOSTS. *Leptomastix nigra* was recorded as a parasitoid of *Pseudococcus* sp. on oleander by Compere (1938). The host is very probably *Paracoccus burnerae*, as this mealybug on *Nerium oleander* has been recorded as the host for *Leptomastix nigra* by Prinsloo (1981). In addition, the species is recorded below from *Octococcus africanus* on *Stoebe cinerea*; *Octococcus ?minor* on *Athenasia trifurcata*; *Octococcus pentziae* on *Metalasia muricata* and *Pentzia globosa*; *Octococcus* on *Elytropappus*; *?Octococcus* on *Stoebe* and *Elytropappus gnaphaloides*; *Paracoccus burnerae* on *?Diospyros lycioides*; *Spilococcus* on *Metalasia muricata* and an unidentified mealybug on *Gazania*. Also recorded below in association with *Parasaissetia nigra* (Homoptera: Coccidae) on *Loranthus elegans*, *Saissetia somereni* (Coccidae) on grapefruit, and *Ceroplastes* sp. (Coccidae) on *Metalasia muricata*, but these are unlikely to be the true hosts.

DISTRIBUTION. Zimbabwe, Namibia, South Africa.

MATERIAL EXAMINED.

Type material. Holotype ♀ of *Leptomastix nigra*, **South Africa**, Tvl, Johannesburg, May 1937 (*Compere*) (BMNH). Paratypes: **South Africa**, 1♀, 2♂, Tvl, Johannesburg, ex mealybug, iv.1937 (*Compere*).

Other material. **Zimbabwe**, 5♀, Salisbury, near Harare and Chishawasha, various dates iii.1979–vii.1982

(*Watsham*); **Namibia**, 1♀, Helmeringhausen, with *Parasaissetia nigra* on *Loranthus elegans*, T6925, v.1973 (*Prinsloo*); 2♀, 2♂, Otavi, ex mealybug on unidentified plant, T6928, 17.v.1973 (*Prinsloo*); 4♀, Karibib, ex mealybug, T6931, 16.ii.1978 (*Kok*); 6♀, 1♂, Otavi, ex mealybug, T6930, 24.ii.1978 (*Kok*); **South Africa**, 6♀ and 9♂, OFS, Edenville, OFS, ex *Octococcus pentziae* on *Pentzia globosa*, T2503, i.1970 (*Insley*); 17♀, C.P., Jeffreys Bay, ex mealybug in axils of *Gazania rigens*, T6916, 3.i.1980 (*Neser*); 19♂, C.P., Jeffreys Bay, ex mealybug in axils of *Gazania*, T6917, 3.i.1980 (*Neser*); 2♀, 7♂, Tvl, S. of Pongola, 27°23'S 30°38'E, ex *Saissetia somereni* on grapefruit, T6932, vii.1979 (*Kambourov*); 1♀, C.P., Witzenberg Vall., 3, 000ft, 19.i.1921 (*Turner*); 1♀, 1♂, C.P., Paarl District, ex ?*Octococcus* on *Stoebe*, T2736, x.1968 (*Insley*); 2♀, 2♂, C.P., Du Toits Kloof Pass, ex ?*Octococcus* sp. on *Elytropappus gnaphaloides*, T2795, x.1968 (*Insley*); 4♀, 1♂, Du Toits Kloof Pass, ex mealybug on *Metalasia muricata*, T2832, x.1968 (*Insley*); 2♀, 2♂, C.P., Villiersdoorp, ex. mealybug on *Stoebe* sp., T3205, x.1969 (*Insley*); 8♀, 9♂, C.P., Swellendam, T3226, ex *Spilococcus* sp. on *Metalasia muricata*, x.1969 (*Insley*); 3♀, C.P., Stellenbosch, ex *Octococcus* ?*minor* on *Athenasia trifurcata*, T3231, x.1969 (*Insley*); 8♀, 15♂, C.P., Jeffreys Bay C.P., ex *Octococcus* sp. on *Metalasia muricata*, T3378, iii.1970 (*Insley*); 3♀, C.P., Garcia Pass, ex *Octococcus* sp., T3414, iii.1970 (*Insley*); 1♀, 4♂, C.P., Stellenbosch, on *Stoebe plumosa*, T5383, v.1978 (*Neser*); 4♀, 3♂, C.P., Kleimond, ex *Octococcus africanus* on *Stoebe cinerea*, T5475, viii.1978, (*Neser*); 2♀, 4♂, C.P., Floraberg, ex prob. *Octococcus* sp. on *Metalasia* sp., T5793, vi.1978 (*Neser*); 7♀, 1♂, C.P., Franschhoek Pass, ex *Octococcus pentziae* on *Metalasia muricata*, T5883, xii.1978 (*Neser*); 2♀, 15♂, C.P., D.F Malan Airport C.P., ex *Octococcus* prb. *pentziae* on *Metalasia muricata*, T6114, iv.1979 (*Neser*); 3♂, C.P., D.F. Malan Airport, with *Ceroplastes* sp. on *Metalasia muricata*, 10.iv.1979 (*Neser*); 4♀, 1♂, C.P. Goudini, ex. prob *Octococcus* sp., on *Stoebe* sp., T6914 (*Neser*); 5♀, 1♂, C.P., Goudini, ex prob. *Octococcus* sp. on *Elytropappus rhinocerotis*, T6920, 25.ix.1979 (*Neser*); 5♂, CP, Algeria, Cadarberg, ex prob. *Octococcus* sp. on *Elytropappus* sp. cf. *gnaphaloides*, T6921 16.vii.1979 (*Neser*); 4♀, 1♂, C.P., Sir Lowry's Pass rd. nr. Somerset, ex *Octococcus* sp. on *Athenasia* sp., T6922, 29.viii.1979 (*Neser*); 6♂, Tvl, Irene, ex *Paracoccus burnerae* on ?*Diospyros lycioides*, T6927, 16.iii.1969 (*Insley*); 14♀, 15♂, C.P., Capetown, D.F Malan Airport, ex *Octococcus* prb. *pentziae* on *Metalasia muricata*, T6230, vii.1980 (*Neser*); 2♀, 1♂, C.P., Gamtoos Sta., with *Ceroplastes* sp. on *Metalasia muricata*, T6933, 22.xi.1983 (*Grobbelaar*). Material in BMNH, PPRI.

COMMENTS. *Leptomastix nigra* is extremely close to *nigrocoxalis* and may represent different forms of that species. In general, the two can be separated by the relative width of the frontovertex and position of the ocelli in the females, with some degree of overlap between unusually small specimens of *nigrocoxalis* from India and specimens identified here as *nigra*. In *nigra* the frontovertex is almost always half as wide as the head or wider and OOL:OCL is at least 1.4, whilst in *nigrocoxalis* the frontovertex is less than half the head width except in the smallest specimens and OOL:OCL is less than 1.4. Other differences, such as coloration, may be unreliable, but in *nigra* the axillae and frontovertex are nearly always dark brown and in *nigrocoxalis* at most only the occipital margin is marked with brown and the axillae are always orange. The males can be separated only by the coloration of the frontovertex and axillae (see key), but this is probably unreliable.

Darker females of *Leptomastix nigra* are similar to *Leptomastix abyssinica*, both species having a general dark brown coloration and forewing about 2.7× as long as broad. They can be separated by the colour of the clypeal area and prosternum, and the number of lines interrupting the linea calva. In *nigra* the clypeal area and prosternum are dark brown and there are four or five lines of setae interrupting the linea calva (Fig. 34), whereas in *abyssinica* the clypeal area and prosternum are yellow and there are only two lines of setae interrupting the linea calva (Fig. 58). Paler females of *nigra*, those which are generally orange but have dark axillae, can be mistaken for *flava*, a species known from Mediterranean Europe and the Middle East. However, in *flava* the forewing has the postmarginal vein about as long as the stigmal vein and the mandibles are orange, whereas in *nigra* the postmarginal vein is at least 1.5× as long as the stigmal and the mandibles are dark brown. *Leptomastix nigra* can also be very similar to *herreni*, both species exhibiting the same range of colour variation (see comments under *herreni*)

Leptomastix dactylopii Howard

(Figs 39–46, 63, 70)

Leptomastix dactylopii Howard, 1885:23–24. Lectotype ♀(designated Noyes & Hayat, 1994), USA, USNM examined.

Leptomastix superba Silvestri, 1915:348. Holotype ♀, Eritrea, INMP examined. **Syn.n.**

Leptomastix longipennis Mercet, 1927:497–498. Lectotype ♀(designated Noyes, 1981), Eritrea, IEEM, examined. Synonymized with *Leptomastix dactylopii* by Noyes & Hayat (1994).

Leptomastix bifasciatus Compere, 1938:323–325. Holotype ♀, Tanzania, examined. Synonymized by Noyes & Hayat (1994).

Paraleptomastix dactylopii (Howard); Mani, 1939:70–71.

Leptomastix tambourissae Risbec, 1952:16–19. Lectotype ♀ (designated Noyes & Hayat, 1994), Madagascar, MNHN, examined. Synonymized by Noyes & Hayat (1994).

[*Leptomastix flavus* Mercet; Risbec, 1951:103; Meyerdirk & Newell, 1979:72. Misidentification.]

DIAGNOSIS. Female (length 1.10–2.30 mm): body including gaster yellow to orange, moderately robust and stout; head with dark-brown area adjacent to each eye, extending across occiput towards foramen; mesopleuron yellow, concolorous with mid coxa; mesosternum dark-brown; wings more or less hyaline (Fig. 40), sometimes with two distinct fuscous longitudinal streaks (Fig. 41); position of posterior ocelli relative to eyes and occiput variable; F1 about 2× length of pedicel; forewing fairly wide, about 3× as long as broad (Figs 40, 41); postmarginal vein at least 1.5× as long as stigmal (Fig. 43); linea calva interrupted by at most two lines of setae (Fig. 42); gaster as long as thorax; ovipositor about 12× as long as gonostyli. Male (length 0.90–1.54 mm): generally similar to female, but posterior margin and dorsal part of pronotum and anterior margin of mesoscutum brownish; antenna (Fig. 63) clothed with long setae, each at least 4× as long as diameter of F1; basal two-thirds of clava with 9 or so scale-like structures present ventrally; aedeagus about half as long as midtibia; phallobase (Fig. 70) with elongate digiti, each with a pair of apical hooks.

HOSTS. *Leptomastix dactylopii* has been reared from many species of mealybugs. Ashmead (1900) and later Viereck (1916) first recorded *Planococcus citri* (as *Dactylopius destructor*) as its host whilst Mercet (1927) noted that the species (as *L. longipennis*) was a parasitoid of *Ferrisia virgata* and Compere (1938) recorded it from *Pseudococcus longispinus* as *Leptomastix bifasciatus*. *Leptomastix dactylopii* has also been recorded from *Birendracoccus saccharifolii* on sugarcane by Mani (1939), but this is a possible misidentification of *Leptomastix tsukumiensis*. Kerrich (1953) noted it as a parasitoid of *Planococcus vovae* (as *Pseudococcus inamabilis*) while Annecke & Insley (1971) recorded it from *Planococcus aemulor* on *Combretum splendens*. *Leptomastix dactylopii* has also been recorded from stem galls on *Tambourissa* sp. by Risbec (1952), from *Pseudococcus* sp. on guava by Compere (1938), *Pseudococcus bukbensis, Planococcus citri, Ferrisia virgata, Phenacoccus madeirensis, Pseudococcus longispinus* (= *adonidum*) and *Pseudococcus concavocerarii* by Donald (1956), *Planococcus kenyae* on coffee (Noyes & Hayat, 1994), *Pseudococcus occiduus* on *Psidium guajava* by Annecke & Insley (1971), *Planococcoides njalensis* by Strickland (1951), *Planococcoides lamabokensis* by Prinsloo (1983a), *Planococcus kraunhiae* in Japan by Tachikawa (1963a) and *Dysmicoccus brevipes* in Hawaii by Bartlett (1978). The parasitoid has been laboratory reared from the last host in Ghana by Anonymous (1953). Tachikawa (1963b) recorded *Leptomastix dactylopii* from *Phenacoccus gossypii* but this was based on a record of specimens reared from a mixed population of *Phenacoccus gossypii* and '*Pseudococcus krauhniae*', the latter being a misidentification of *Planococcus citri* and therefore the most likely host. *Leptomastix dactylopii* has been reared from several mealybug species in the laboratory: *Phenacoccus gossypii, Phenacoccus solani, Pseudococcus calceolariae, Pseudococcus longispinus* and *Pseudococcus maritimus* by Bess (1939), *Pseudococcus comstocki* by Clancy (1944) and *Planococcus lilacinus* by Krishnamoorthy (1988). Manichote & Middlekauff (1967) noted that *Leptomastix dactylopii* would not attack *Spilococcus leucopogi* (= *cactearum*) in the laboratory. Recorded below from *Delotococcus (=Allococcus) quaesitus* on *Acacia* and *Planococcus ficus* on *Ficus carica* and an unidentified species of *Planococcus* on *Erythrina lysistemon*.

DISTRIBUTION. Senegal, Gambia, Sierra Leone, Ivory-Coast, Togo, Benin, Nigeria, Cameroon, Gabon, Uganda, Zimbabwe, Zambia, Kenya, Seychelles, South Africa, Mauritius, Canada (introduced), USA (introduced), Hawaii (introduced), Caribbean, Costa Rica, Chile, Brazil, Mediterranean Europe (introduced), Pakistan (introduced), India (introduced), Taiwan (introduced) and Australia (introduced).

MATERIAL EXAMINED.

Type material. *Leptomastix dactylopii*: lectotype ♀ on card point labelled '1170o Pars on *Dactylopius destructor* Oct 4.[18]84' 'Type 2649 U.S.N.M. (USNM)'. Paralectotypes 1♂, on single point, labelled '1170o, Oct.4.1884' 'Type No 2649 U.S.N.M.'; 1♀, same data but 14.10[18]84 (USNM). *Leptomastix superba*: holotype ♀ fragmented on a slide, labelled 'Leptomastix superbus Silv. F Nefasit' (INMP). *Leptomastix longipennis*: lectotype ♀ on card labelled 'ex *Pseudococcus virgata*' 'Somalia Italiana' '*Leptomastix longipennis* Mercet' '*Leptomastix longipennis* Mercet Lectotype det. J.S. Noyes, 1979' (IIEM). *Leptomastix bifasciata*: holotype ♀, **South Africa**, Uitenhage, ex *Pseudococcus longispinus* on oleander, 12.i.1937 (*Compere*) (BMNH). Paratypes: **Tanzania** (as Tanaganyika), 3♀, Bukoba, ex *Pseudococcus* on guava, 20.vii.1935 (*Ritchie*) (BMNH). *Leptomastix tambourissae*: lectotype ♀, labelled 'Elevage du 1.4.50 Eclos 20.6.50 No G20P galles de tege des *Tambourissa* sp. d'Ambatoloana (R.P.)' 'Encyrtidae *Leptomastix tambourissae* Risbec T' (MNHN). Paralectotypes: 3♀, 1♂ (not four as stated by Risbec, 1952) remounted from same slide

onto card rectangles as lectotype (MNHN, BMNH).

Non-type material. No data, 1 ♀ (misidentified as *L. flava* by Risbec); **Senegal**, 1 ♀, 3 ♀, Bambey, ex coccid, (*Risbec*); 2 ♀, Bambey, ex *Pseudococcus* on *Prosopis*, 12.x.1945 (*Risbec*) (misidentified as *L. flava* by Risbec); **Gambia**, 1 ♂, Bakan, i.78 (*Huggert*); 2 ♂, Fajara, i.78 (*Huggert*); **Sierra Leone**, 1 ♂, Njala, ex mealybug on *Cassiea javanica*; **Ivory Coast**, 7 ♀, 1 ♂, Lamto, 6°13'N 5°02'W, MT/YPT, xi.1988 (*Noyes*); 2 ♂, Korhogo, 18–21.iii.1984 (M. Matthews); 1 ♀, 3 ♂, Gagnoa, 2–5.iii.1984 (*Matthews*); 1 ♀, 3 ♂, Bouaffle; **R.P. Benin**, 5 ♀, 7 ♂, 15Km N. Cotonou, Abomey-Calavi, MT, xii.1988 (*Noyes*); **Togo**: 2 ♀, Kpalime, xii.1988 (*Noyes*); **Nigeria**, 3 ♀, 1 ♂, Kaduna St. 20km N., 8.xi.1987, (*Noyes, Neuenschwander*); 5 ♀, 5 ♂, Ibadan, IITA compound, MT/YPT, xi.1987 (J.S.Noyes); 6 ♂, Zaria, 8.xi.1987 (J.S. Noyes); **Cameroun**, 2 ♀, 2 ♂, S.W. Cameroun, Musone, Lake Mboandong, 11.xii.1981 (*Compton*); 2 ♀, 3 ♂, Victoria Bot. Gdns, 6.xii.1981, (*Compton*); 1 ♀, Nyassosso, Mt Koupe, 8.i.1982 (*Compton*); **Gabon**, 2 ♀, 2 ♂, Foret de la Mondah, 15–25km N.Libreville, 25.xi–3.xii.87 (*Noyes*); **Uganda**, 1 ♀, Bujumbura, iv.1939 (*Taylor*); 3 ♀, 4 ♂, ex *Pseudococcus kenyae* on *C. arabica*, 12.iv.1938 (*Melville*); **Zimbabwe**, 6 ♀, 3 ♂, Salisbury, i.1979 (*Watsham*); 6 ♀, 2 ♂, Harare, Chishawasha, xii.1982 (*Watsham*); **Zambia**, 9 ♀, 13 ♂, 15km E.Lusaka, 27.xi–29.xii.1979 and 11–19.ii.1980 (*Beaver*); **Kenya**, 1 ♀, Nairobi, ii.1982, Brit. Mus. 1982–347; 3 ♂, Gazi, viii.1982 (*Barnett*); **South Africa**, 18 ♀, 29 ♂, Cape Province, 10–22.xii.1930, Brit. Mus. (*Turner*); 1 ♀, Mossel Bay, April.1921, 1921–210, (*Turner*); 3 ♀, Blyderivierspoortdam Nat. Reserve, 29°32'5, 30°47'E, 25–26.x.1984, (*Prinsloo*); 1 ♀, Cape Province, Grahamstown, i.1979 (*Prinsloo*); 1 ♀, 1 ♂ Letaba, ex suction trap on citrus, T2504, xi.1966 (*Catling*); 4 ♀, 1 ♂ Cape Province, Ashton, ex mealybug on *Ficus carica*, T5306, iii.1978 (*Neser, Kok & Urban*); 1 ♀, Okahandja, 2–18.iii.1928; 1 ♀, Transvaal, Roodeplaat, nr Pretoria, ex *Allococcus quaesitus* on *Acacia* sp., T4292, iii.1992, (*Insley*); 1 ♂, Mogol Nature Reserve, Ellisras Dist. 23°58'S 27°45'E, 27–29.ii.1984 (*Prinsloo*); 1 ♂, Entabeni Forest Res. Soutlanberg, 25°00'S 30°16'E, 3–7.xi.1980 (*Prinsloo*); 1 ♂, C.P., Jeffreys Bay, with unidentified coccoidea on *Euclea* sp., T6918, 13.i.1980 (*Neser*); 1 ♂, Natal, Umzinto, ex *Planococcus* sp. on *Erythrina lysistemon*, T4135 i.1972 (*Insley*); 2 ♀, C.P., De Dooms, ex *Planococcus ficus* on *Ficus carica*, T6919; **Mauritius**, 2 ♂, Rose Hill, 29.ix.32 (*Mamet*). Material in BMNH, PPRI, MNHN.

Voucher material. **Israel**, 1 ♀, California, Riverside, lab culture, ex *Planococcus citri*, 30.viii.1974, R74–81–1, shipped, reared and released in California, Porterville by Meyerdirk as *Leptomastix flavus*; 1 ♀, 1 ♂, Negev, lab reared, California, Porterville, ex comstock mealybug, Warkentin, R76–42, 17.v.1976, shipped and released in California, Porterville, by Meyerdirk as *Leptomastix flavus*; 1 ♂, Sde Boker, lab culture, California, Porterville, ex *Planococcus vitis* on grape, R–75–34–2B, 30.iv.1975, shipped, reared and released in California, Porterville by Meyerdirk as *Leptomastix flavus*. Material in UCR and part of a longer series of voucher material of the species released in California from Israel and referred to by Meyerdirk & Newell (1979) as *Leptomastix flava*.

COMMENTS. The holotype of *Leptomastix superba* is mounted on a slide and in very poor condition, but it is clearly the same as *Leptomastix dactylopii* and therefore we have no hesitation in treating the two names as synonymous.

Females of *Leptomastix dactylopii* are similar in general appearance to *Leptomastix tsukumiensis*, both species having similar habitus and generally yellow coloration of body and mid coxae (see comments under *tsukumiensis*). The males are very similar to those of *nigrocoxalis*, *nigrocincta*, and *nigra* and can be difficult to separate. Males of these four species can be separated using the characters given in the key, although it is likely that these characters are not totally reliable.

Leptomastix jonesi Noyes **sp. n.**

(Figs 47–48, 64)

DIAGNOSIS. Female (length 1.58–2.24 mm): body mostly yellow, but with temples part of occiput, mesosternum, mid coxae externally and occasionally mesopleuron brown; gaster orange brown; posterior ocelli about equidistant from eye and occipital margins; antenna with F1 about 3× as long as pedicel; forewing about 3× as long as broad, with a longitudinal fuscous streak along anterior wing margin from apex of venation and another parallel streak in disc (similar to Fig. 47); postmarginal vein about 2× as long as stigmal and slightly longer than marginal; linea calva interrupted by 4 or 5 lines of setae. Male (length 1.77–1.83 mm): generally similar to female, antenna (Fig. 64) clothed with long setae, each at least 3× as long as diameter of F1; basal two-thirds of clava with 9 or 10 slender, elongate and straight scale-like structures ventrally; forewings (Fig. 47) with two fuscous longitudinal streaks as in female; postmarginal vein about 1.5× as long as stigmal (Fig. 48); aedeagus less than one-third as long as midtibia; phallobase with elongate digiti, each with three apical hooks.

FEMALE (HOLOTYPE). Length 2.21 mm. Head orange with a small brown spot on interantennal prominence dorsally, temples and occiput laterally dark brown; radicle dark brown; scape brown with ventral margin yellow; pedicel brown; flagellum dark brown; dorsum of thorax mostly orange with neck of pronotum and extreme anterior part of mesoscutum

brown; mesosternum and metanotum dark brown, remainder of thorax orange; legs orange except for mid coxae which are dark brown laterally; gaster orange-brown dorsally, orange laterally and ventrally.

Head with inner eye margins subparallel, diverging slightly ventrally; posterior ocelli about equidistant from eye and occipital margins; scape about 5.5× as long as broad; F1 3× as long as pedicel; clava very slightly shorter than F1 and 1.6× as long as F6; pedicel about 2× as long as broad. Relative measurements: HW 50.5; HH 44; FV 21; SL 33.5; SW 6.

Mesoscutum and scutellum with coriaceous sculpture; forewings 3× as long as broad, with postmarginal vein very nearly 2× as long as stigmal and a little longer than marginal; linea calva interrupted by 4 or 5 lines of setae; hindwing 4.5× as long as broad.

Gaster slightly longer than thorax, with ovipositor hidden. Relative measurements: OL 38.5, GL 5.5 [MT 84].

MALE. See diagnosis. Relative measurements (specimen 1): HW 93, FV 48, POL 17, OOL 10.5, OCL 7, EL 53, EW 35, MS 23, SL 52, SW 11.5; (specimen 2): FWL 148, FWW, 54.5, AL 22, MT 80.

VARIATION. Very little, but the female excluded from the type series has the mesopleuron brown instead of orange.

HOSTS. Unknown.

DISTRIBUTION. South Africa.

MATERIAL EXAMINED.
Type material. Holotype ♀ (slide-mounted), **South Africa**, Cape Province, Mossel Bay, xii.1921 (*Turner*). Paratypes: 1♂, same data as holotype; 1♀, Cape Province, Mossel Bay, 18–30.xi.1921 (*Turner*); 1♂, Cape Province, Mossel Bay, vi–vii.1930 (*Turner*); 3♀, Cape Province, Somerset East, 1–26.i.1931 (*Turner*). Holotype in BMNH, paratypes in BMNH and PPRI.

Non type material. **South Africa**, 1♀, Pondoland, Port St John, ix.1923 (*Turner*)

COMMENTS. *Leptomastix jonesi* is superficially very similar to *dactylopii* and females of the two species can be difficult to separate with certainty. In *jonesi* the mid coxae are partially brown, the linea calva is interrupted by at least 4 lines of setae, the ovipositor is less than half as long as the mid tibia and only about 7× as long as the gonostyli whereas in *dactylopii* the mid coxae are completely orange or yellow, the linea calva is generally interrupted by only 2 lines of setae, the ovipositor is at least about 10× as long as the gonostyli and more than half as long as the mid tibia. The males of *jonesi* are fairly easy to separate from those of *dactylopii* and other species of the genus by the scale-like structures at the base of the clava being very elongate, slender and straight (Fig. 64). In the only other species where these structures are slender (*herreni*) they are relatively short and apically strongly curved (Fig. 61).

The species is named in honour of Mr Peter Jones for his contribution to children's education.

Leptomastix nigrocincta Risbec

(Figs 49–55)

Leptomastix nigrocincta Risbec, 1959:27. Lectotype ♀, designated by Noyes & Prinsloo (1988), Madagascar, MNHN, examined.

Leptomastix lyciae Noyes & Hayat, 1994:275–278. Holotype ♀, India, BMNH, examined. **Syn.n.**

DIAGNOSIS. Female (length 0.91–2.20 mm): body including base and venter of gaster yellow to orange, dorsum of gaster at least partially dark brown; head always with a dark-brown area on temple adjacent to each eye extending a short way onto occiput towards foramen; base of mandibles yellow; mesopleuron generally orange, rarely dark brown (see below); prosternum and mesosternum adjacent to coxae usually with a distinct brown tinge; mid coxae always dark-brown or black; propodeum dark-brown above coxae; wings hyaline or with a pair of longitudinal fuscous streaks(Fig. 51); position of posterior ocelli variable (see below), but usually ocelli about equidistant from eye and occipital margin; antenna (Figs 49, 50) with F1 about 1.7 to 2.3× as long as pedicel; forewing (Fig. 51) about 3× as long as broad; postmarginal vein slightly longer than marginal and at least nearly twice as long as stigmal (Fig. 53); linea calva interrupted by two or three lines of setae, rarely by four (Fig. 52); gaster as long as thorax; ovipositor about 6.5× as long as gonostyli. Male (length 0.80–1.59 mm): similar to female but darker, although mid coxae not or hardly dusky; funicle clothed in long setae, longest about 4× as long as diameter of F1; a line of six or so scale-like structures ventrally on base of clava; forewing (Fig. 54) about 2.5× as long as broad; postmarginal vein distinctly longer than marginal which is subequal in length to stigmal (Fig. 55); aedeagus about one-third length of mid tibia.

VARIATION. Very little variation has been noted in material from India, China and the African mainland, but specimens from Madagascar exhibit a striking degree of variation in coloration and some minor morphological characters. In Malagasy females the area between the toruli and eyes is sometimes marked with black as is the median area of the pronotum; the mesoscutum may have a wedge-shaped dark brown area; the tegulae vary from almost completely orange to completely dark brown or black; the axillae may be dark brown laterally; the mesopleuron is sometimes almost entirely black. In the Malagasy material the

frontovertex varies from slightly less than two-fifths head width to nearly half with a corresponding variation in the relative position of the posterior ocelli. In some specimens the posterior ocelli are distinctly nearer the occipital margin whilst in others they are distinctly nearer the eyes with the angle formed varying from about 50° to only slightly less than 90°. In the Malagasy material the relative width of the funicle segments varies with some specimens having slender antennae with F6 about 2.5× as long as broad and others having slightly broader segments with F6 slightly less than 1.5× as long as broad (compare Figs 49, 50); the postmarginal vein varies from about 2.0–2.5× as long as the postmarginal vein. Males from Madagascar exhibit a similar, but less marked range of variation.

HOSTS. *Leptomastix nigrocincta* was recorded as a parasitoid of mealybugs on *Hibiscus* sp. by Risbec (1959). Recorded in India from *Coccidohystrix insolita* and *Phenacoccus* sp. (probably misidentification of *C. insolita*) on aubergine, *Solanum melongena* L. (Noyes & Hayat, 1994).

DISTRIBUTION. Togo, Zambia, Madagascar, India, China.

MATERIAL EXAMINED.
Type material. Lectotype ♀ of *nigrocincta*: 'Elevage du 5.12.50 No 810 Eclose du 20.12.50 Parasites des cochenilles sur le feuille d'Hibiscus sp. de Tsimbazaza (R.P.) Inst. Scient. Madagascar' 'Leptomastix nigrocincta', remounted on a card rectangle and labelled 'LT ♀' on ventral side of card (MNHN). Paralectotypes: 6 ♀, 3 ♀, remounted on card rectangles, same data as lectotype. Lectotype of *nigrocincta* in MNHN, paralectotypes in MNHN and BMNH. Holotype ♀ of *lyciae*: **India**, Delhi, IARI area, x.1979 (*Boucek*). Paratypes: 53 ♀, 13 ♂ from **India** and **China** as detailed in Noyes & Hayat (1994). Holotype of *lyciae* in BMNH, paratypes in BMNH, USNM, CNC, AMU, PPRI, QM.

Non-type material. **Togo**, 10 ♀, 10km NW Kpalime, xii.1988 (*Noyes*); **Zambia**, 1 ♀, Lusaka, 6–12.xi.1979 (*Beaver*); **Madagascar**, 1 ♂, Tananarive, Angavokely for sta., 28km E. Angavokely, 24.iv.1983 (*Noyes*) 2 ♀, 2 ♂, Perinet, 27.iv.–3.v. 1983 (*Noyes*, *Day*); 51 ♀, 70 ♂, Tulear, Berenty 12km, NW Amboasary, 5–15.v.1983 (*Noyes*, *Day*); 3 ♀, 11 ♂, Tulear, Bereboka 60km, N.E. Morondova, 18–23.v.1983 (*Noyes*, *Day*); 1 ♀, 20km S. Mandrivazo, 24.v.1983 (*Noyes*, *Day*). Material in BMNH, PPRI.

COMMENTS. As we are unable to find any consistent differences to discriminate between the type series of *lyciae* and the long series of *nigrocincta* from Madagascar, we are here treating the two species as synonymous.

Females of *Leptomastix nigrocincta* can be very similar to *nigrocoxalis* and might be mistaken for that species. In general, both species have similar coloration with the body generally yellowish with the mid coxae partially dark brown. The two species can be separated by the coloration of the base of the mandibles and number of lines of setae interrupting the linea calva. In *nigrocincta* the mandibles are entirely yellowish and the linea calva is interrupted by at most three lines of setae (very rarely four), whilst in *nigrocoxalis* the bases of the mandibles are dark brown and the linea calva is interrupted by four or more lines of setae. In general, males are very similar to those of *nigrocoxalis*, *nigrocincta*, and *nigra* and can be difficult to separate. They can be separated using the characters given in the key, although it is likely that these characters are not totally reliable. Females of *Leptomastix nigrocincta* can also be similar to those of *Leptomastix africana*, both species having the posterior ocelli closer to eyes than occiput, F1 at least 2× as long as pedicel; mesopleuron brown, postmarginal vein distinctly longer than stigmal, and only two lines of setae interrupting the linea calva. They differ in general coloration, and relative length of postmarginal vein. In *nigrocincta* the body is largely pale orange and the postmarginal vein is about 2.6× as long as the marginal vein and about 3× as long as the stigmal vein, whereas in *africana* the body is entirely dark brown and the postmarginal vein is twice as long as either the marginal or stigmal veins. At a glance, females of some colour forms of *nigrocincta* might be confused with those of *herreni*, but the two species can be separated easily on the relative length of the postmarginal vein. In *nigrocincta* the postmarginal vein is at least nearly twice as long as the stigmal (Fig. 53) whilst in *herreni* it is about as long as the stigmal (Fig. 18). *Leptomastix nigrocincta* might also be mistaken for *histrio* or *epona*, both of which are Palaearctic and currently unknown in the Afrotropical region. Females of *nigrocincta* differ from those of the two other named species in always having the postmarginal vein at least nearly twice as long as the stigmal, the mid coxae dark brown and the linea calva generally interrupted by not more than three lines of setae, whereas in *histrio* and *epona* the postmarginal vein is only about 1.5× as long as the stigmal and the mid coxae are yellow, except in the darkest specimens where the linea clava is interrupted by at least five lines of setae.

Leptomastix abyssinica Compere

(Figs 56–60)

Leptomastix abyssinica Compere, 1931:267–9.
Holotype ♀, Eritrea, not examined, USNM.

DIAGNOSIS. Female (length 1.60–2.40 mm): body including gaster generally brown to dark-brown; head

with inner eye margins, genal area and area below toruli yellow; antennae dark brown with ventral margin of scape yellow or translucent; prosternum and fore coxae yellow; mid and hind coxae orange-brown; wings hyaline; posterior ocelli about equidistant from eye and occipital margins; antenna (Fig. 56) with F1 about 2.5× length of pedicel; forewing (Fig. 57) about 2.9× as long as broad, with postmarginal vein about 1.75× as long as stigmal (Fig. 59); linea calva interrupted by 2 lines of setae (Fig. 58); gaster as long as thorax; ovipisitor about 10× as long as gonostyli. Male (length 1.30–1.70 mm): generally similar to female but for antennae and genitalia; yellow coloration of head more extensive then in female; antennae with about 10 scale-like structures ventrally on base of clava; forewing (Fig. 60) about 2.5× as long as broad; linea calva interrupted by only a single setae; aedeagus about one-third as long as mid tibia, each digitus with two long apical teeth.

HOSTS. *Leptomastix abyssiuica* has been recorded from *Planococcus citri* on *Olea chrysophylla* (Compere, 1931, 1938).

DISTRIBUTION. Eritrea.

MATERIAL EXAMINED.

Type material. Paratypes: **Eritrea**, 11 ♀, 3♂, Nefasit, ex *Pseudococcus citri* on *Olea chrysophylla*, iii.1930 and iv.1930 (*Compere*); 1 ♀, Nefasit, ex *Pseudococcus citri* on *Olea chrysophylla*, iv.1930 (*Compere*); 3 ♀, 2♂, Nefasit, ex *Pseudococcus* No 4630 on *Olea chrysophylla*, 15.iv.1930 (*Compere*); 1♂, Nefasit, ex *Pseudococcus* No 4630 on *Olea chrysophylla*, 16.iv.1930 (*Compere*); 1 ♀, Nefasit, on window, out of mealybug, 31.iii.1930 (*Compere*). Material in BMNH and UCR.

Non type material. **Eritrea**, 5♂, Nefasit, ex *Pseudococcus* No 4630 on *Olea chrysophylla*, 11.iv.1930 (*Compere*); 4♂, Nefasit, ex *Pseudococcus* No 4630 on *Olea chrysophylla*, 10.iv.1930 (*Compere*); 1 ♀, Ezdaclesan, ex *Croton macrostachys*, 1.v.1930 (*Compere*); 5 ♀, 1♂, Nefasit, ex *Pseudococcus citri* (*Compere*). Material in UCR.

COMMENTS. *Leptomastix abyssinica* is close to *Leptomastix africana*, females of both species having similar dark-brown general coloration, the forewing about 2.7–2.9× as long as broad and two lines of setae interrupting the linea calva. They differ by the colour of the scape, lower face, prosternum and forelegs, position of posterior ocelli in relation to occipital margin and relative length of the clava. In *abyssiuica* the scape is yellow ventrally, the lower face, prosternum and fore coxae are yellow, the posterior ocelli are equidistant from the eye and occipital margins and the clava is longer than F1 (Fig. 56), whereas in *africana* the scape is entirely brown, the prosternum and coxae are dark brown, the posterior ocelli are nearer the occipital margin and the clava is shorter than F1 (Fig. 22). Males of the two species can be separated by colour as in the female. *Leptomastix abyssiuia* might also be mistaken for *Leptomastix uigra* (see comments under *nigra*).

HOSTS OF AFRICAN SPECIES OF *LEPTOMASTIX*

* extralimital record
? doubtful record
! laboratory rearing

HEMIPTERA

Coccidae

Parasaissetia nigra (Nietner) (=*Saissetia uigra*) – ?**nigrocoxalis*
Saissetia nigra, see *Parasaissetia nigra*

Dactylopiidae

Dactylopius destructor, see *Planococcus citri* (Pseudococcidae)

Margarodidae

Icerya aegyptiaca (Douglas) – **uigrocoxalis*

Pseudococcidae

Allococcus quaesitus, see *Delottococcus quaesitus*
Bireudracoccus saccharifolii (Green) (=*Pheuacoccus saccharifolii*) – ?**dactylopii*
Coccidohystrix – **uigrocoxalis*
Coccidohystrix iusolita (Green) – **uigrocincta*, **nigrocoxalis*
Delottococcus quaesitus (Brain) (= *Allococcus quaesitus*) – *dactylopii*
Dysmicoccus brevipes (Cockerell) – **dactylopii*
Ferrisia virgata (Cockerell) – *dactylopii*, **tsukuniensis*
Maconellicoccus hirsutus (Green) – *nigrocoxalis*
Nipaecoccus – **uigrocoxalis*
Nipaecoccus grauiuis (Maskell) – *nigrocoxalis*
Nipaecoccus viridis (Newstead) – *uigrocoxalis*
Octococcus – *herreni*, *africaua*, *uigra*
Octococcus africauus (Brain) – *nigra*
Octococcus minor De Lotto – *nigra*
Octococcus pentziae Hall – *herreni*, *nigra*
Paracoccus burnerae (Brain) – *nigra*
Phenacoccus – **nigrocincta*
Phenacoccus gossypii Townsend & Cockerell – !?**dactylopii*
Phenacoccus madeireusis Green – *dactylopii*
Phenacoccus saccharifolii, see *Birendracoccus saccharifolii*
Phenacoccus solani Ferris – !*dactylopii*
Planococcoides njalensis (Laing) – *dactylopii*

Planococcoides lamabokensis Balachowsky & Ferrero – *dactylopii*
Planococcus – *dactylopii*
Planococcus aemulor De Lotto – *dactylopii*
Planococcus citri (Risso) (= *Dactylopius destructor*) – *abyssinica*, *dactylopii*, **nigrocoxalis*
Planococcus ficus (Signoret) – *dactylopii*
Planococcus kenyae (Le Pelley) – *dactylopii*
Planococcus kraunhiae (Kuwana) – **dactylopii*
Planococcus lilacinus (Cockerell) – *dactylopii*
Planococcus vovae (Nasonov) – **dactylopii*
Pseudococcus – *dactyolopii*, *nigra*, *nigrocoxalis*
Pseudococcus adonidum, see *Pseudococcus longispinus*
Pseudococcus bukbensis Laing – *dactylopii*
Pseudococcus calceolariae (Maskell) – !*dactylopii*
Pseudococcus comstocki (Kuwana) – !*dactylopii*
Pseudococcus concavocerarii James – *dactylopii*
Pseudococcus inamabilis, see *Planococcus vovae*
Pseudococcus longispinus (Targioni Tozzetti) (= *Pseudococcus adonidum*) – *dactylopii*
Pseudococcus occiduus De Lotto – *dactylopii*
Rastrococcus cappariae Avasthi & Shafee – **nigrococalis*
Rastrococcus iceryoides (Green) – **nigrocoxalis*
Spilococcus – *nigra*

NEUROPTERA

Nimboa basipunctata Withycombe – ?**nigrocoxalis*

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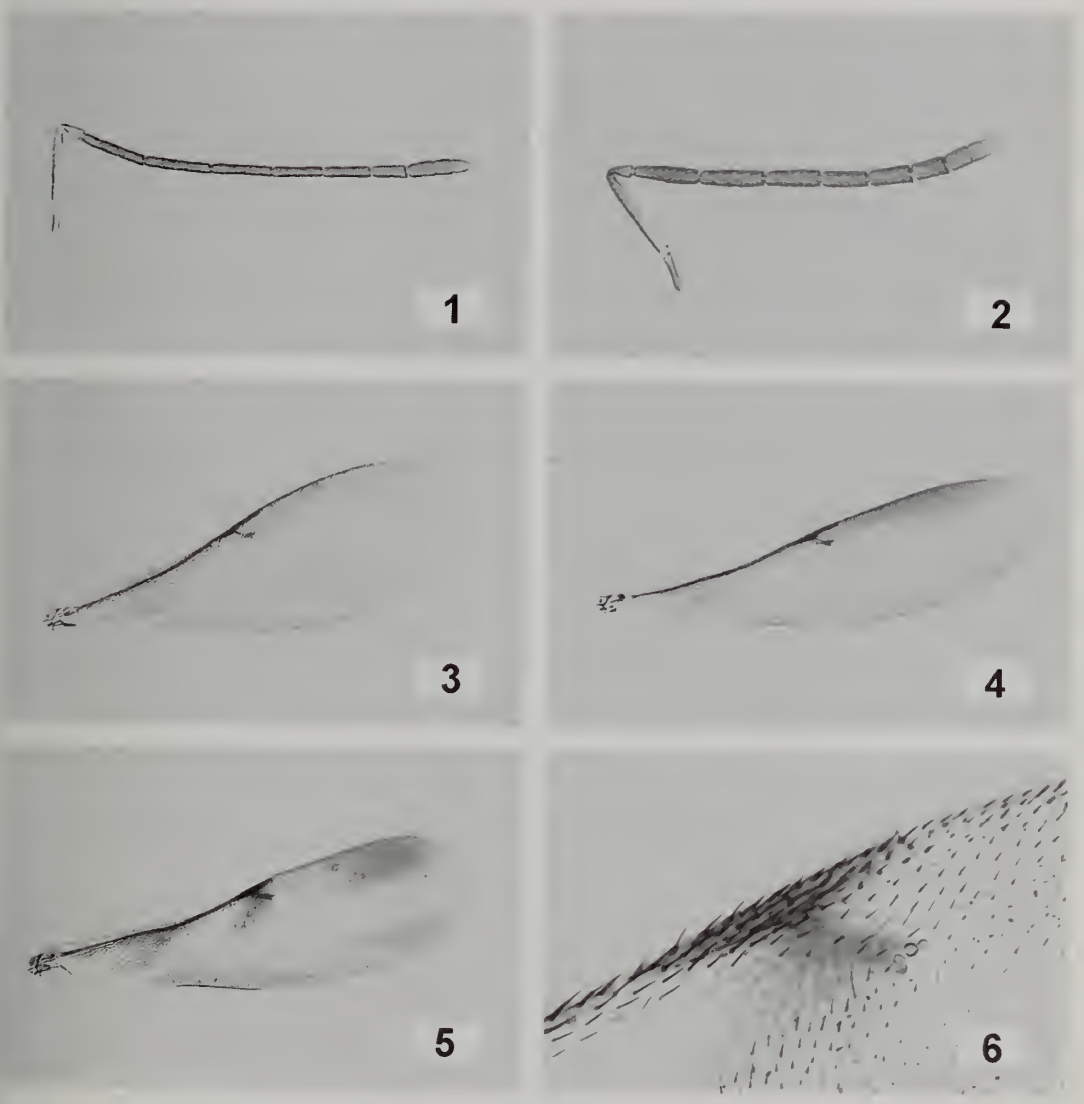
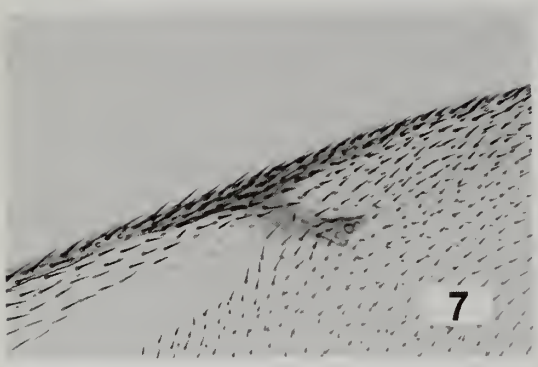
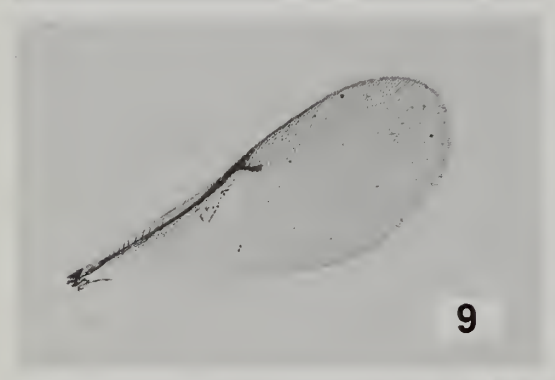
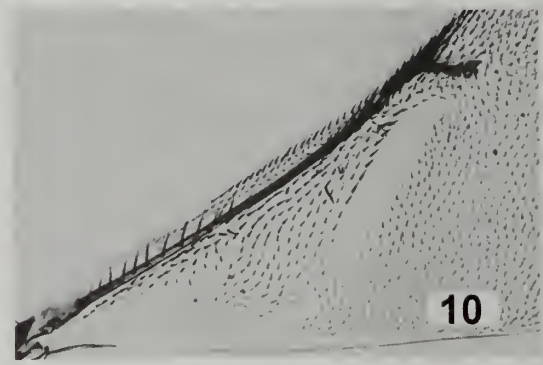
Synonyms and misidentifications are in *italics*; main citations in **bold**.

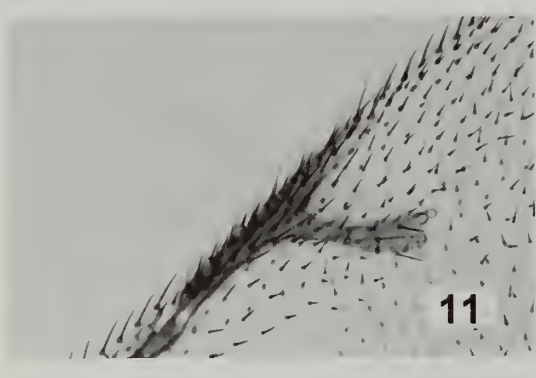


Figs 1–6. *Leptomastix tsukumiensis* – 1, antenna, variant, ♀; 2, antenna, variant, ♀; 3, forewing, variant, ♀; 4, forewing, variant, ♀; 5, forewing, variant, ♀; 6, forewing, apex of venation, variant, ♀.

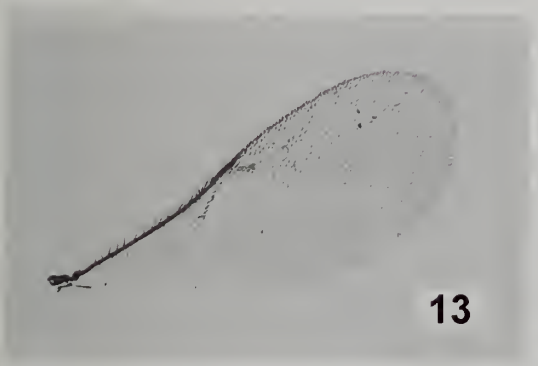


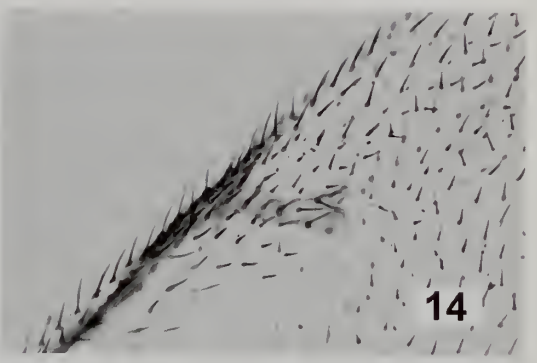


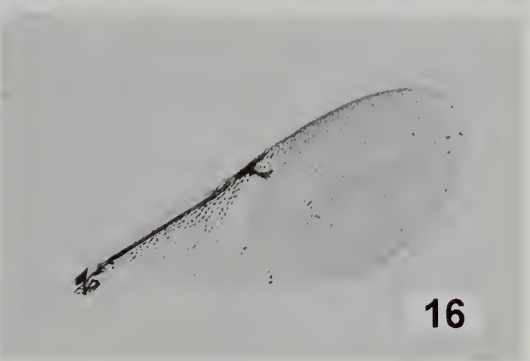


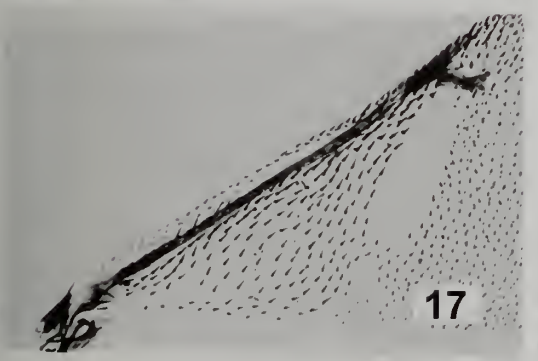


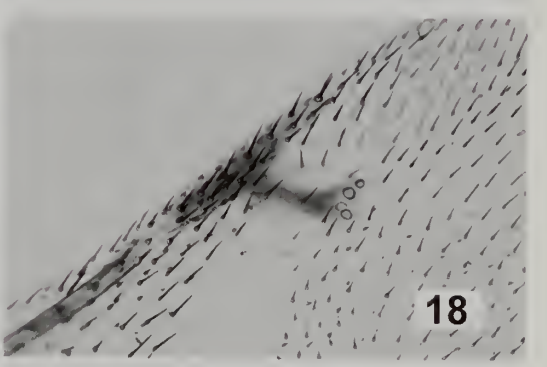
Figs 7–12. *Leptomastix tsukumiensis* – 7, forewing, apex of venation, variant, ♀. *Leptomastix digitariae* – 8, antenna, ♀; 9, forewing, ♀; 10, forewing base, ♀; 11, forewing, apex of venation, ♀; 12, ovipositor.



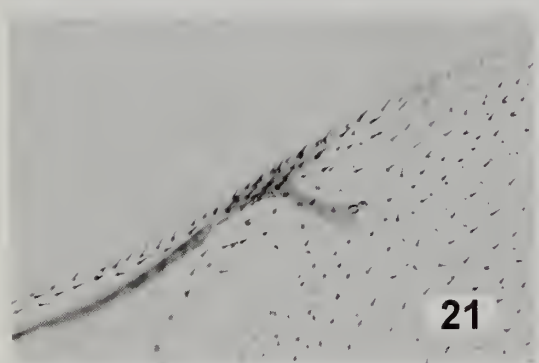


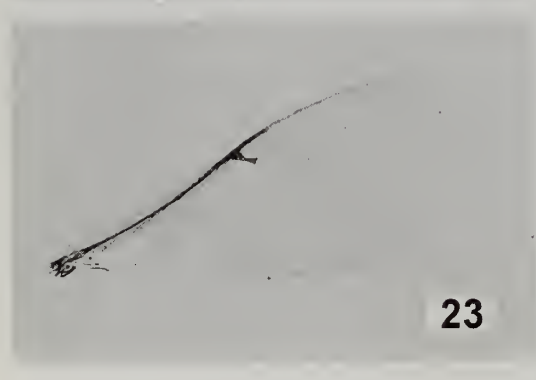


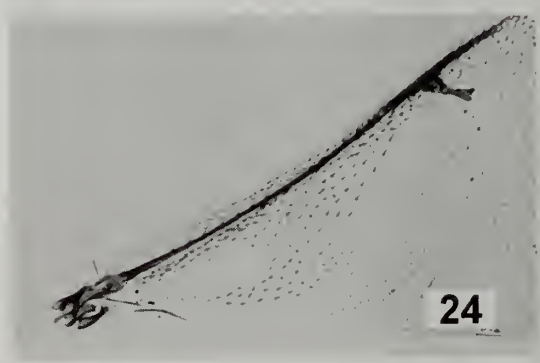




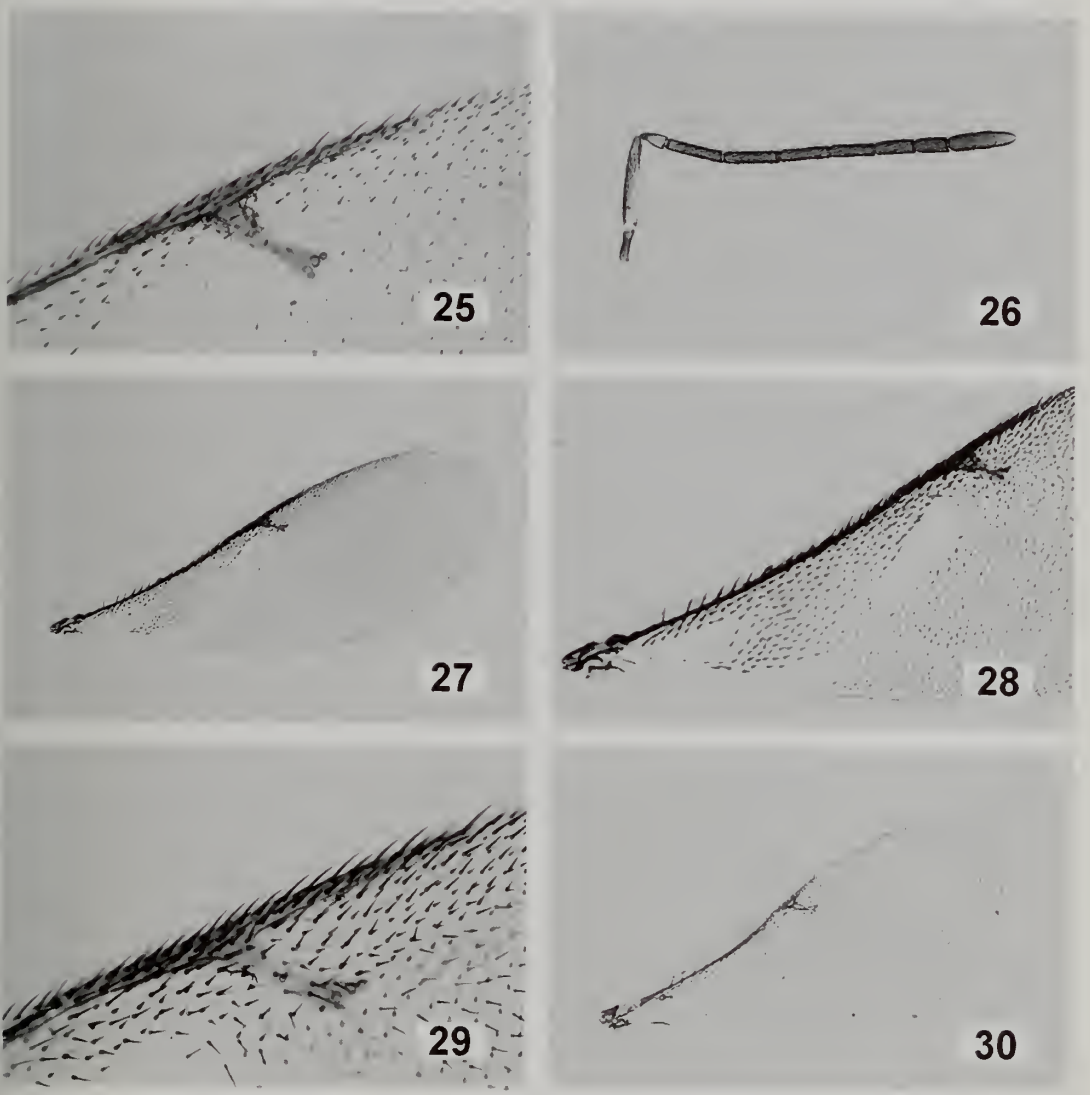
Figs 13–18. *Leptomastix digitariae* – 13, forewing, ♂; 14, forewing, apex of venation, ♂. 15–18, *Leptomastix herreni* – 15, antenna, ♀; 16, forewing, ♀; 17, forewing base, ♀; 18, forewing, apex of venation, ♀.



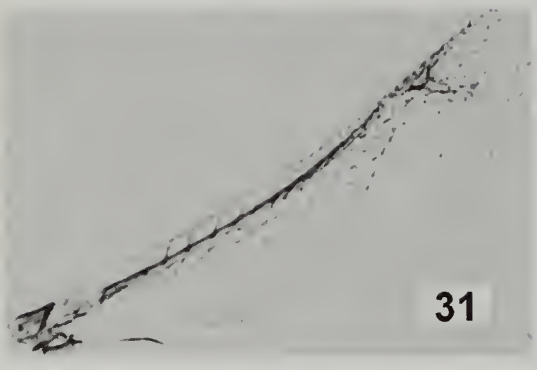


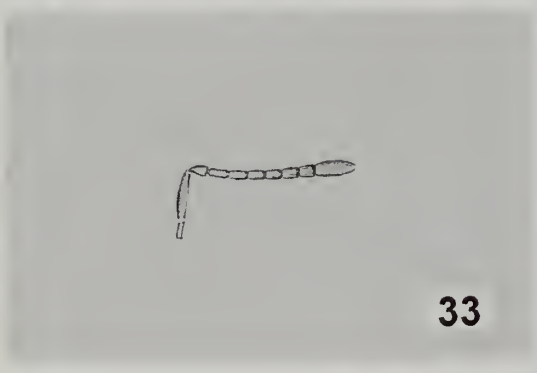


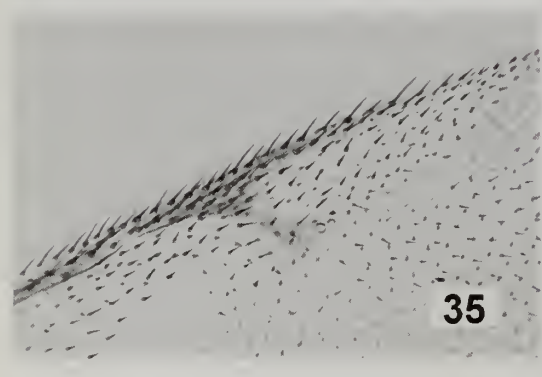
Figs 19–24. *Leptomastix herreni* – 19, ovipositor; 20, forewing, apex of venation, ♂. *Leptomatix algirica* – 21, forewing, apex of venation. *Leptomastix africana* – 22, antenna, ♀; 23, forewing, ♀; 24, forewing base, ♀.

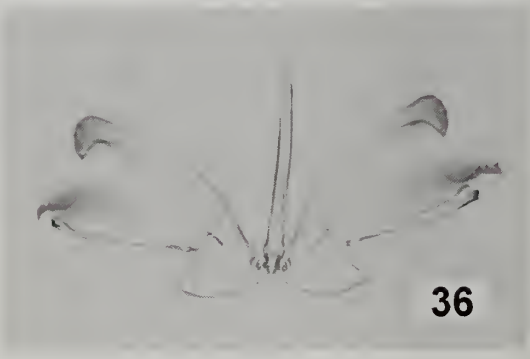


Figs 25–30. *Leptomastix africana* – 25, forewing, apex of venation, ♀. *Leptomastix nigrocoxalis* – 26, antenna, ♀; 27, forewing, ♀; 28, forewing base, ♀; 29, forewing, apex of venation, ♀; 30, forewing, ♂.



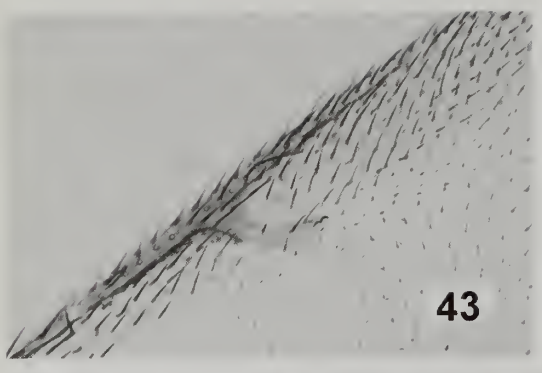




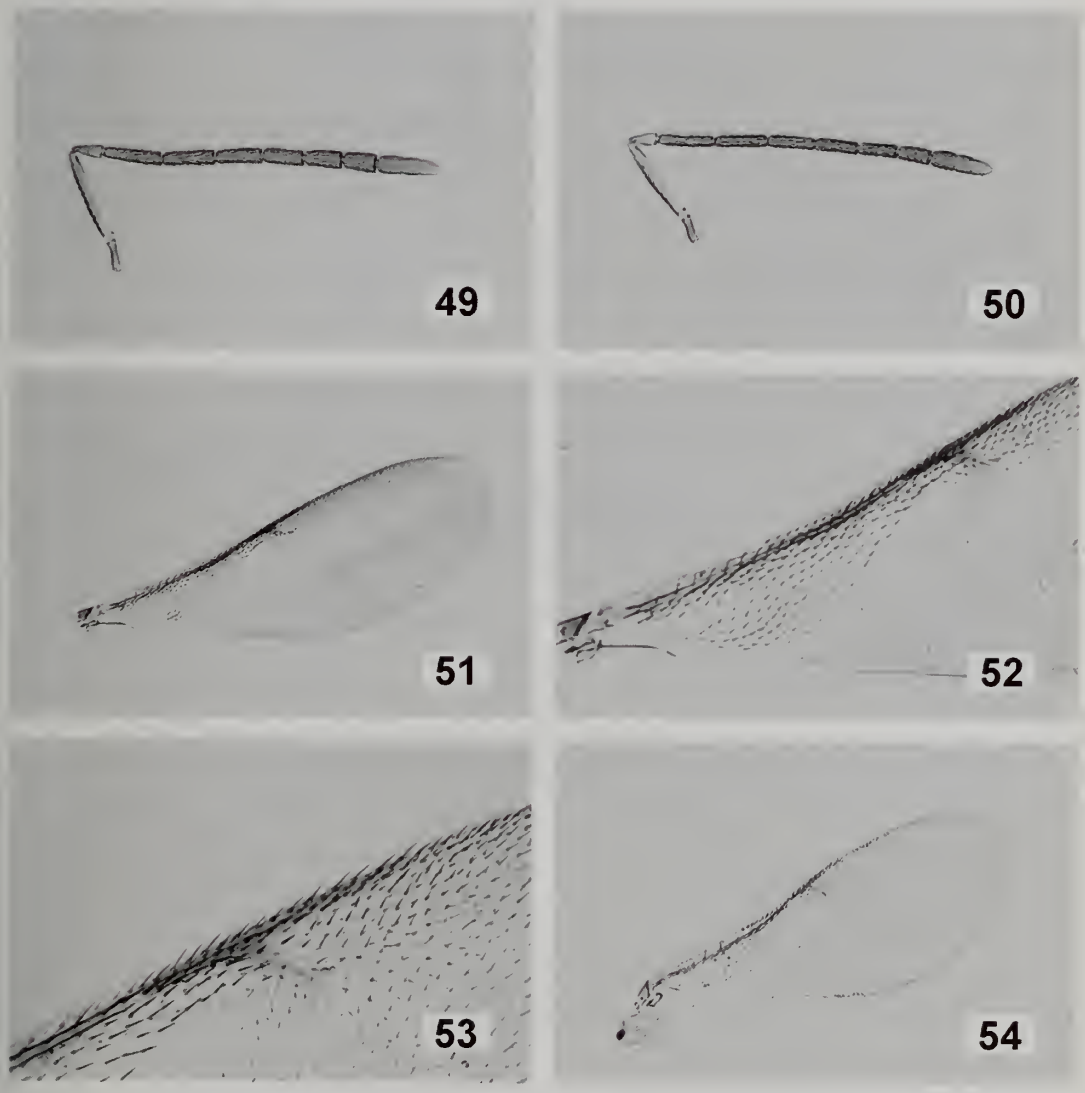


Figs 31–36. *Leptomastix nigrocoxalis* – 31, forewing base, ♂. *Leptomastix nigra* – 32, antenna, large specimen, ♀; 33, antenna, small specimen, ♀; 34, forewing, ♀; 35, forewing, apex of venation, ♀; 36, ovipositor.

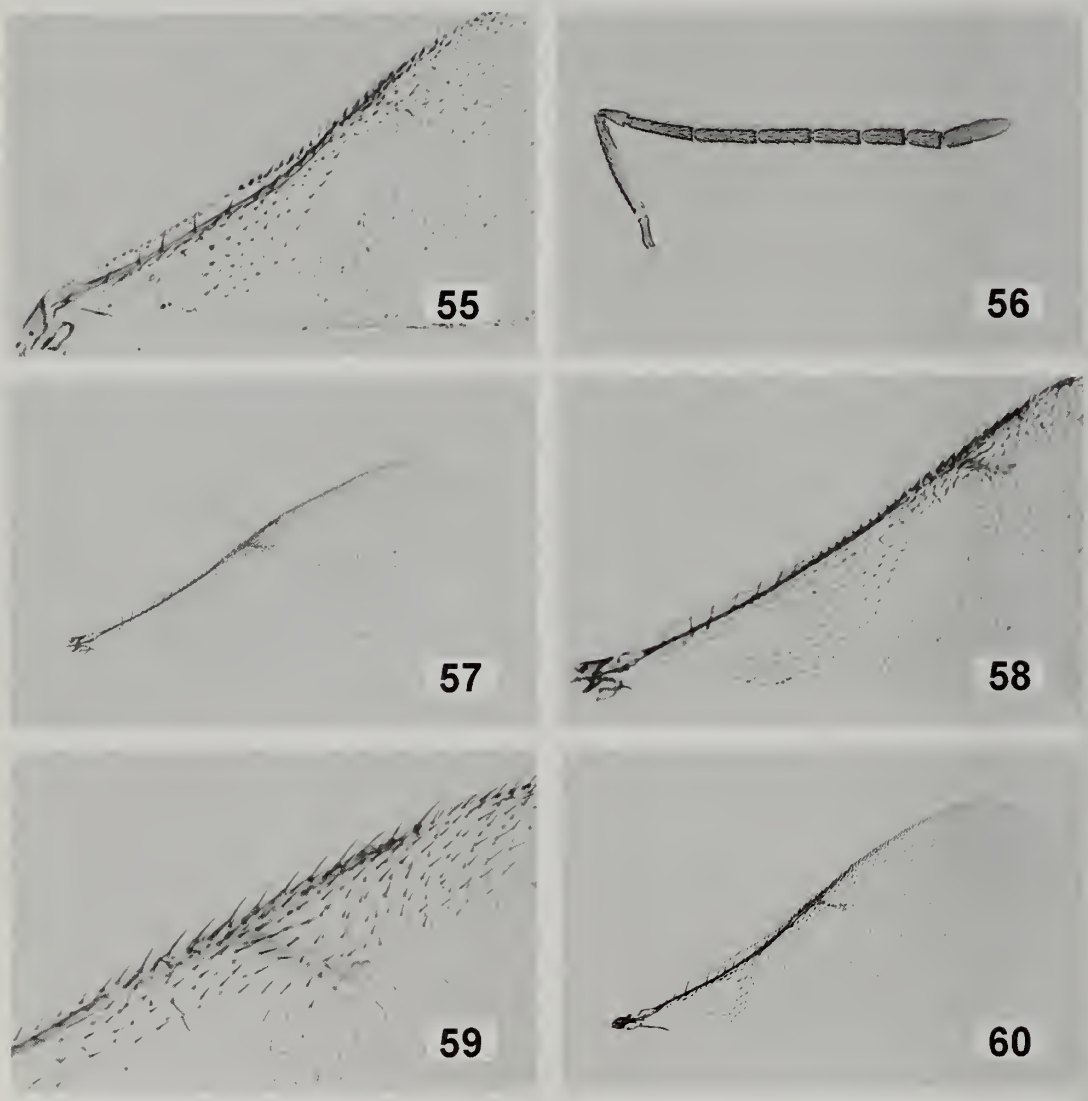
Figs 37–42. *Leptomastix nigra* – 37, forewing, ♂; 38, forewing base, ♂. *Leptomastix dactylopii* – 39, antenna, ♀; 40, forewing, variant, ♀; 41, forewing, variant, ♀; 42, forewing base, ♀.



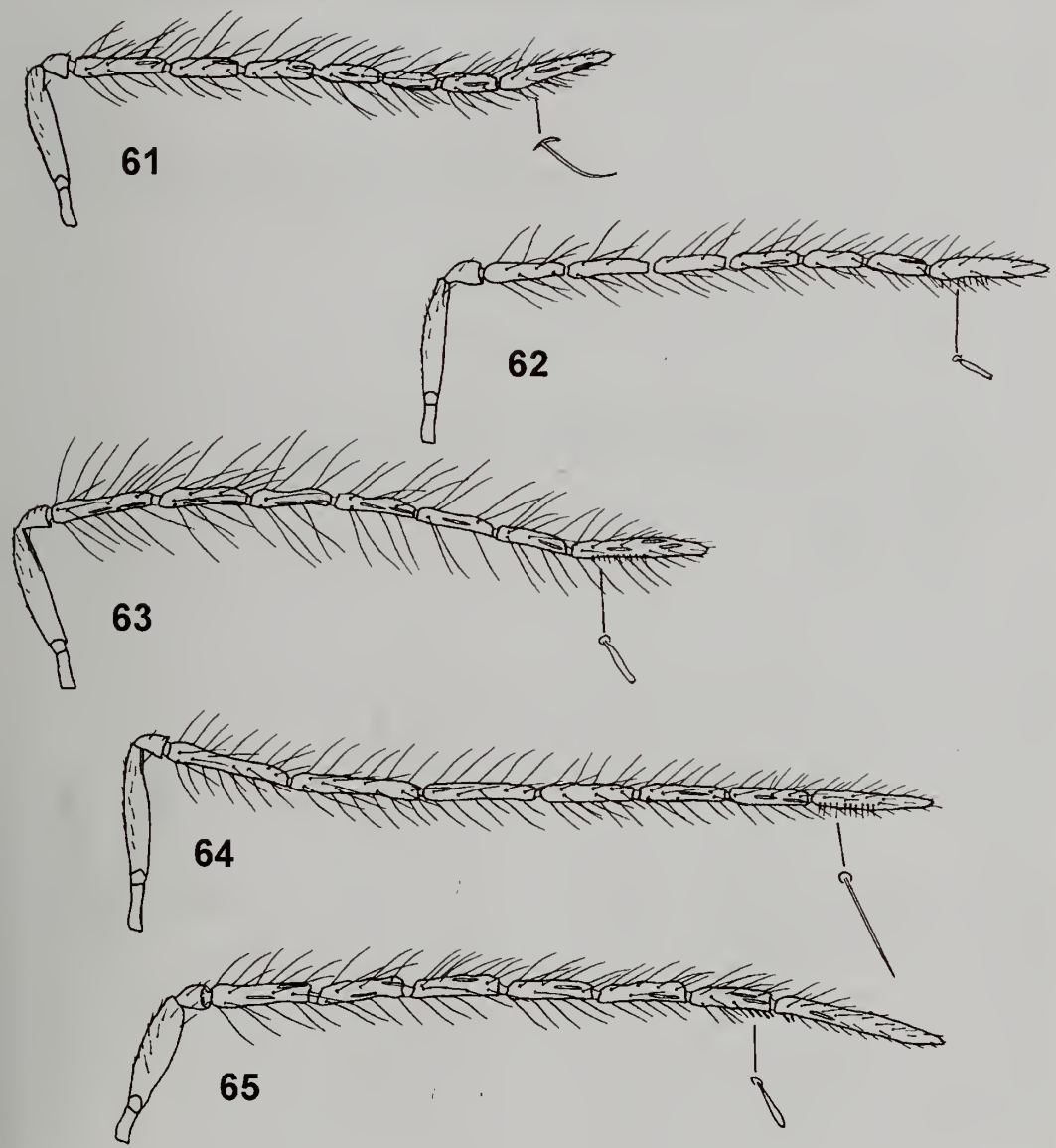
Figs 43–48. *Leptomastix dactylopii* – 43, forewing, apex of venation, ♀; 44, forewing, ♂; 45, forewing base, ♂; 46, forewing, apex of venation, ♂. *Leptomastix jonesi* – 47, forewing, ♂; 48, forewing, apex of venation, ♂.



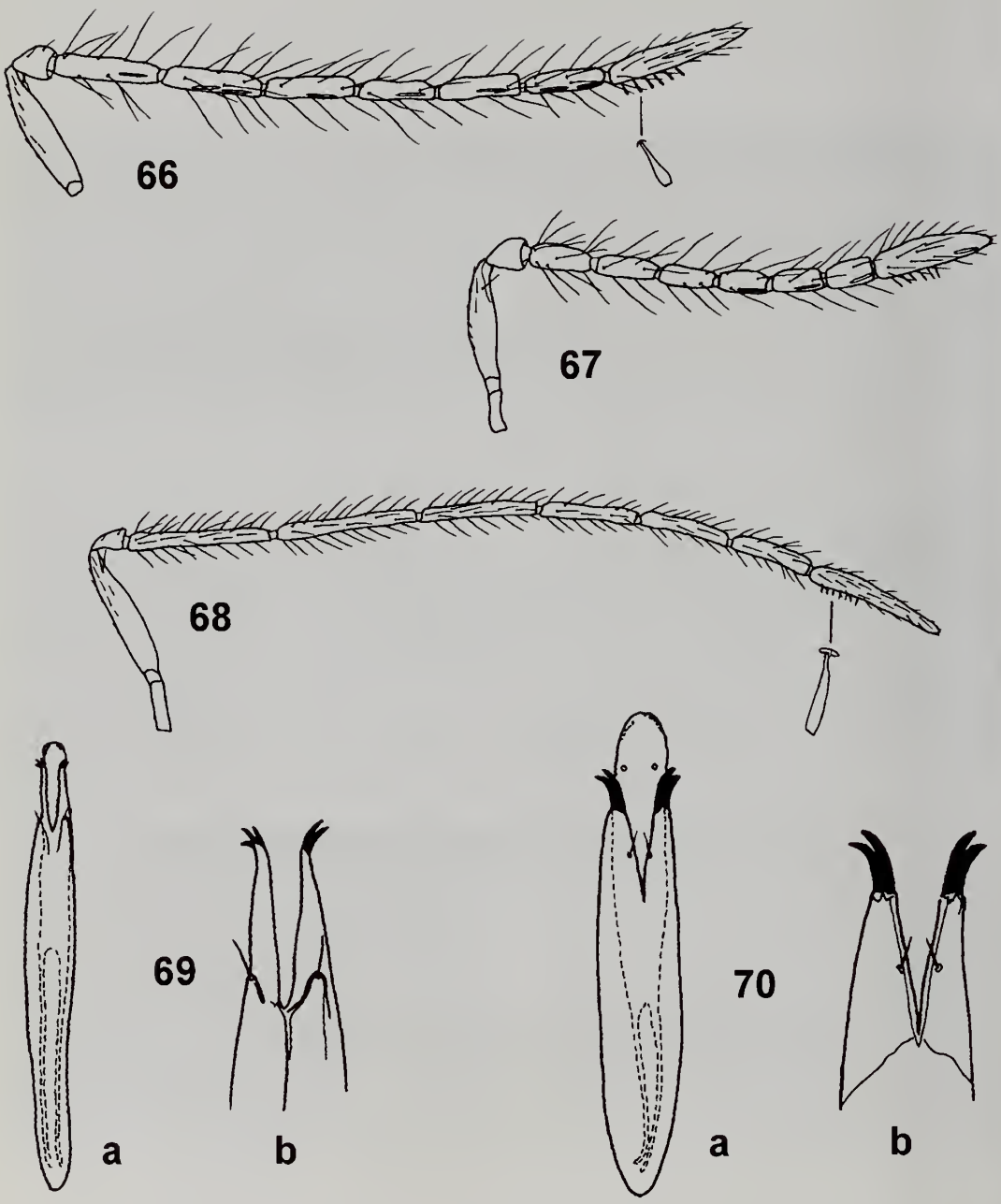
Figs 49–54. *Leptomastix nigrocincta* – 49, antenna, variant, ♀; 50, antenna, variant, ♀; 51, forewing, ♀; 52, forewing base, ♀; 53, forewing, apex of venation, ♀; 54, forewing, ♂.



Figs 55–60. *Leptomastix nigrocincta* – 55, forewing base,♂. *Leptomastix abyssinica* – 56, antenna, ♀; 57, forewing, ♀; 58, forewing base, ♀; 59, forewing, apex of venation, ♀; forewing,♂.



Figs 61–65. *Leptomastix herreni* – 61, antenna, scale-like structure enlarged, ♂. *Leptomastix algirica* – 62, antenna, scale-like structure enlarged, ♂. *Leptomastix dactylopii* – 63, antenna, scale-like structure enlarged, ♂. *Leptomastix jonesi* – 64, antenna, scale-like structure enlarged, ♂. *Leptomastix digitariae* – 65, antenna, scale-like sstructure enlarged, ♂.



Figs 66–70. *Leptomastix nigra* – 66, antenna, larger specimen, scale-like structure enlarged,♂; 67, antenna, smaller specimen,♂. *Leptomastix tsukumiensis* – 68, antenna, scale-like structure enlarged,♂. *Leptomastix digitariae* – 69, genitalia, (a) complete, (b) apex of phallobase enlarged,♂. *Leptomastix dactylopii* – 70, genitalia, (a) complete, (b) apex of phallobase enlarged,♂.